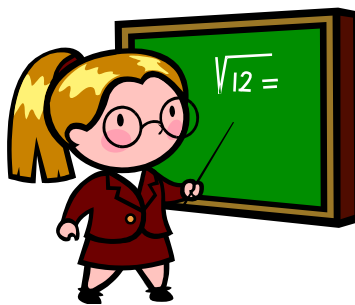


How Do You Expect Me To Teach Math?

Teacher Handbook



A TOOL BOX OF NUMERACY STRATEGIES FOR
CAREER AND TECHNICAL EDUCATION TEACHERS



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NC CTE COMPREHENSIVE SUPPORT MODEL

“The New Literacy”

“No longer can we accept that a rigorous mathematics education is reserved for the few who will go on to become engineers or scientists.

Mathematics may indeed be “the new literacy”---at the very least, it is essential for any citizen who is to be prepared for the future.”

From the Final Report of the National Mathematics Advisory Panel, 2008

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Pretest

1. Strategy # _____	Shade $\frac{1}{3}$ of this rectangle. 	
2. Strategy # _____	Vicki earned \$29.75 for working $3\frac{1}{2}$ hours. What was her hourly wage?	
3. Strategy # _____	Greg wants to leave a 15% tip on a \$35 meal. How much should he leave?	
4. Strategy # _____	When Eric left home, the odometer on his car read 32,416 miles. When he arrived at his destination it read 33,027. How many miles had he traveled? If he used 47 gallons of gas, how many miles per gallon did he get?	
5. Strategy # _____	How much interest would Wendy be charged on a loan of \$1,000 with an interest rate of 5.5%?	

North Carolina's CTE Performance Indicators

Carl D. Perkins Career and Technical Education Act of 2006

1. (1S1) Academic Attainment: Reading/Language Arts

By 2009-2010, 41.5% of CTE Concentrators who left secondary education in the reporting year will have met the proficient or advanced level on the statewide high school reading/language arts assessment.

2. (1S2) Academic Attainment: Mathematics

By 2009-2010, 74.5% of CTE concentrators who left secondary education in the reporting year will have met the proficient or advanced level on the statewide high school mathematics NCLB assessment.
(Note: 2007-2008---76.9 2008-2009---76.6)

3. (2S1) Technical Skill Attainment

By 2009-2010, 73.0% of CTE participants will have met the proficient or advanced level on statewide post assessments in the reporting year.

4. (3S1) Secondary School Completion

By 2009-2010, 87.6% of CTE Concentrators leaving secondary education in the reporting year will have earned a diploma.

5. (4S1) Student Graduation Rates

By 2009-2010, 81.5% of CTE Concentrators will count as graduated in the state's computation of its cohort graduation rate for NCLB.

6. (5S1) Secondary Placement

By 2009-2010, 91.25% of CTE Concentrators who left secondary education in the previous school year will be in postsecondary education or advanced training, in military service, or in employment.

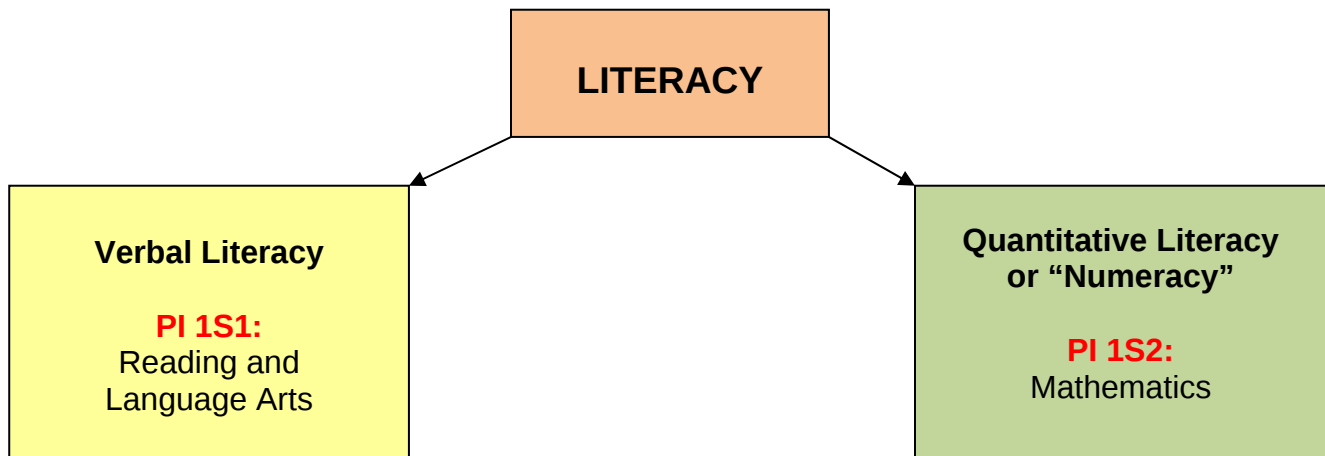
7. (6S1) Nontraditional Participation

By 2009-2010, 26.0% of participants in a course that leads to nontraditional employment are of the nontraditional gender.

8. (6S2) Nontraditional Completion

By 2009-2010, 20.0% of the students who completed a program that leads to employment in nontraditional fields are of the nontraditional gender.

Part 2. What is Numeracy?



What is “Numeracy”?

- The ability to interpret and understand numeric symbols and relationships.
- The ability to communicate and represent mathematical concepts in a variety of ways.
- The development of mathematical culture and a way of thinking and looking at the world in a mathematical way.

Source: SREB, 2007

Why is Numeracy Important?

- To function in today's society, mathematical literacy (what the British call “numeracy”) is as essential as verbal literacy. These two kinds of literacy, although different, are not unrelated.
- Without the ability to read and understand, no one can become mathematically literate. Increasingly, the reverse is also true: without the ability to understand basic mathematical ideas, one cannot fully comprehend modern writing such as that which appears in the daily newspapers.

Source: National Research Council, 2001

Three Reasons Why Numeracy is Important

- 1. Economy and Employability**
 - “I advise my students to listen carefully the moment they decide to take no more math courses. They might be able to hear the sound of closing doors.” (James Caballero, 1991)
- 2. National Security**
 - National Security Agency—www.nsa.gov
- 3. Democracy**
 - “To develop an informed citizenry and to support a democratic government, schools must graduate students who are numerate as well as literate.” (Lynn Arthur Steen, 1999)

Source: National Research Council, 2001

The Need for Numeracy

Numeracy is a serious problem in the US:

- 78% of adults cannot explain how to compute the interest paid on a loan
- 71% cannot calculate miles per gallon on a trip
- 58% cannot calculate a 15% tip for a lunch bill.
- 45% of eighth graders cannot solve a word problem that requires dividing fractions
- 27% cannot correctly shade $\frac{1}{3}$ of a rectangle

Source: FOUNDATIONS FOR SUCCESS, The National Mathematics Advisory Panel Final Report, 2008

Numeracy Applications to Various Careers

Architects	Use geometry and computer graphics for design, statistics and probability to model usage, and calculus to understand engineering principles.
Cinematographers	Use computer graphics to enhance scenes, as well as to create digital images.
Doctors	Need the ability to understand statistical evidence and to explain risks with sufficient clarity to develop "informed consent."
Emergency Medical Personnel	Need to interpret dynamic graphs from cardiac monitors to distinguish significant irregularities from regular patterns and common pathologies.
Farmers	Use satellite imaging data, soil samples, geographic information systems, and algorithms for geometric projections to create terrain maps that reflect soil chemistry and moisture levels.
Financial Advisors	Use mathematical models to balance risk and return and to determine the value of intangible assets.
Insurance Agents	Need to understand and be able to explain to their customers the complicated conditions under which policies pay out and how such payments are calculated.
Journalists	Need a sophisticated understanding of risks, rates, samples, surveys, and statistical evidence to develop an informed and skeptical understanding of claims and studies.
Lawyers	Rely on careful logic to build their cases and on subtle arguments about probability to establish or refute reasonable doubt.
Manufacturing Technicians	Use statistical process control to analyze production data to detect patterns that might signal an impending reduction in quality before it actually happens.
Musicians	Use symmetry and ratios to transform compositions, as well as digital codes to compose and record.
Nurses	Need to understand how to calculate dosages of medicines to match available medicines with prescribed levels.
Politicians	Mine census and other data from governmental agencies to forecast the needs of society and the costs of proposed policies.
Social Workers	Need to understand complex regulations about income and expenses to explain and verify their clients' personal budgets.
Teachers	Use computer spreadsheets to organize assessment data into forms suitable for gauging student learning and diagnosing strengths and weaknesses.

Source: Steen, 2007

Part 3: The Challenges

Challenge # 1: “Math Anxiety”

In recent years, researchers and educators have delved further into the topic of “math anxiety,” or the ways in which students’ lack of confidence in that subject undermines their academic performance. Today, the issue is receiving renewed attention from academic scholars and others, who believe that developing a better understanding of the causes and implications of math anxiety is a key to improving achievement for many students.

When Mark Ashcraft, a professor of cognitive psychology at the University of Nevada, Las Vegas, first began examining the impact of anxiety on math performance, he assumed that students’ unease or nervousness amounted to “an attitude,” rather than a phobia with a direct link to the brain’s processes. “I was wrong,” he says now.

A number of researchers, including Mr. Ashcraft, say there is evidence that anxiety disrupts student performance in math by wreaking havoc with “working memory.” Such capacity is a type of short-term memory individuals use to retain a limited amount of information while working on a task---and block out distractions and irrelevant information. Anxiety can zap students’ working memory during tests, and problem-solving situations.

Some evidence also suggests that anxiety is more of a factor in math than in other subjects. While students who are anxious about math sometimes are equally apprehensive about other subjects, that anxiety does not undermine their performance in areas such as verbal skill to the same extent it does in math. And, while the public may be inclined to see anxiety as simply a byproduct of a student not understanding a math concept or topic, researchers believe students’ self-doubts can in fact be a prime cause of these struggles.

Students feel more anxiety in math partly because they are dealing with so many concepts and procedures that are foreign to them. Once students realize they do not grasp a math concept, the internal pressure grows.

Math entails certain conceptual barriers that lead people to read the same passage over and over again and not understand it. By contrast, in reading a history lesson, students are likely to recognize vocabulary, themes, and ideas, even if they do not understand all the implications of a particular passage. You don’t feel like you totally didn’t understand it, and you’re just floundering.

Anxiety tends to have the most powerful impact on students when they are working on certain types of math problems---typically those with larger numbers, or those requiring multiple steps.

Individuals with high levels of math anxiety tend to rush through problems, making them prone to errors. Those “math-anxious” students also have far more difficulty on problems that require processes such as “carrying” numbers than on questions where such steps are not necessary.

Sheila Ford, a former elementary math resource teacher and principal, believes anxiety is just as likely to affect students in other subjects. But she also believes students’ uneasiness in math tends to rise fast if they sense that a teacher does not have mastery of the material.

“It goes back to teacher preparation and knowledge of the subject matter,” said Ms. Ford. “If the teacher’s uncomfortable with the curriculum, it will be noticeable to the students.”

Source: Education Week, February 21, 2007

Challenge # 2: Making Connections

“One reason students think mathematics is useless is that the only people they see who use it are mathematics teachers!”

Unless teachers of all subjects—both academic and vocational—use mathematics regularly and significantly in their courses, students will treat mathematics teachers’ exhortations about its usefulness as self-serving rhetoric.

To make mathematics count in the eyes of students, schools need to make mathematics pervasive, as writing now is. This can best be done by cross-disciplinary planning built on a commitment from teachers and administrators to make the goal of numeracy as important as literacy.

Virtually every subject taught in school is amenable to some use of quantitative or logical arguments that tie evidence to conclusions.

Measurement and calculation are part of all vocational subjects; tables, data, and graphs abound in the social and natural sciences; business requires financial mathematics; equations are common in economics and chemistry; logical inference is fundamental to history and civics. If each content-area teacher identifies just a few units where quantitative thinking can enhance understanding, students will get the message.

The example of many otherwise well-prepared college students refraining from using even simple quantitative reasoning to buttress their arguments, shows that students in high school need much more practice using the mathematical resources introduced in the elementary and middle grades. Much of this practice should take place across the curriculum.

Mathematics is too important to leave to mathematics teachers alone!

Source: Educational Leadership, November 2007, Volume 65, Number 3

Challenge # 3: “Why Do I Have to Learn This Stuff?”

Students will ask, “Why do I have to learn this stuff? I’ll never use it!” You may have to teach more of the concept than just the answer to the problem at hand so that students will be able to generalize the use of the concept in other applications.

It may be true that students won’t use all of the equations you teach them all of the time. Even if they don’t use everything you teach them, the one thing they will get from learning math is the ability to think. Math is difficult; but if students stick with it, they will eventually be able to comprehend the concepts and will notice that they are far more capable than they once thought

How can we help students value mathematics for its intellectual challenge and exciting power to solve problems? Unfortunately, this question seems to have gone off the radar screen.

According to a 2007 Public Agenda report called “Important, But Not for Me”, the majority of students and their parents polled believe that studying higher-level mathematics is not essential for life in the “real world.”

Students also said that they are most motivated to study higher-level math, not by the arguments about competing in the international economy, but by the need to fulfill college requirements.

Source: TECHNIQUES, March 2009 and Educational Leadership, November 2007, Volume 65, Number 3

Part 4: Where's the Math?

Math as an Integrated Skill Area in CTE Classes in NC

	Course #	Course Name	Date of Blueprint	# Obj. in Course	# Math Related Obj.	% Math Related Obj.
		AGRICULTURE				
1.	6810	Ag Applications	2004	49	19	39%
2.	6811	Ag. Production I	2006	69	46	67%
3.	6812	Ag. Production II	2006	49	31	63%
4.	6821	Animal Science I	2003	54	5	9%
5.	6822	Animal Science II	2003	66	3	5%
6.	6823	Animal Science II: Small Animals	2005	49	4	8%
7.	6825	Equine Science I	2003	59	5	8%
8.	6826	Equine Science II	2004	56	9	16%
9.	6828	Exploring Biotechnology	2004	37	2	5%
10.	6831	Ag Mechanics I	2004	60	33	55%
11.	6832	Ag. Mechanics II	2005	60	44	73%
12.	6833	Ag. Mechanics II (Small Engines)	2003	78	15	19%
13.	6841	Horticulture I	2002	79	16	20%
14.	6842	Horticulture II	2003	88	33	38%
15.	6843	Horticulture II—Turf Grass	2003	64	17	27%
16.	6851	Environmental & Natural Resources Studies I	2004	74	22	30%
17.	6852	Environmental & Natural Resources Studies II	2005	56	13	23%
18.	6871	Biotechnology & Agriscience Research I	2005	48	6	13%
19.	6872	Biotechnology & Agriscience Research II	2005	51	8	16%
20.	6882	Horticulture II—Landscape Cons.	2000	68	42	62%
		BUSINESS & INFORMATION TECH				
21.	6200	Prin. of Business & Per. Finance	2003	46	26	57%
22.	6208	Exploring Business Technologies	2008	22	1	5%
23.	6215	Business Law	2006	20	5	25%
24.	6225	Business Mgt. & Applications	2003	35	6	17%
25.	6235	Small Bus./Entrepreneurship	2003	36	14	39%
26.	6311	Computerized Accounting I	2004	21	19	90%
27.	6312	Computerized Accounting II	2004	36	31	86%
28.	6340	Foundations of Information Technology	2005	32	26	81%
29.	6341	Networking I	2004	32	1	3%
30.	6400	Business Computer Technology	2003	30	18	60%
31.	6411	Comp. Apps. I	2008	12	3	25%
32.	6412	Comp. Apps. II	2009	10	NA	NA
33.	6415	e-Commerce I	2006	24	0	0%
34.	6416	e-Commerce II	2005	32	0	0%
35.	6421	Computer Programming I	2005	45	45	100%
36.	6422	Computer Programming II	2005	29	29	100%
37.	6514	Digital Communication Systems	2004	30	10	33%
38.	6535	Business & Electronic Comm.	1998	37	4	11%
		CAREER DEVELOPMENT				
39.	6145	Career Management	2006	16	2	13%
40.	6158	Exploring Career Decisions	2008	9	0	0%

	Course #	Course Name	Date of Blueprint	# Obj. in Course	# Math Related Obj.	% Math Related Obj.
		FAMILY & CONSUMER SCIENCE				
41.	7015	Teen Living	2004	41	20	49%
42.	7018	Exploring Life Skills	2001	28	11	39%
43.	7035	Apparel Dev. I	2004	39	18	46%
44.	7036	Apparel Dev. II	2004	14	9	64%
45.	7045	Foods: Fundamentals	2004	28	20	71%
46.	7046	Foods II: Advanced	2004	34	10	29%
47.	7055	Housing & Interiors I	2006	34	15	44%
48.	7056	Housing & Interiors II	2005	33	20	61%
49.	7065	Parenting & Child Dev.	2009	17	0	0%
50.	7075	Food Science	2009	20	20	100%
51.	7085	Life Management	2000	41	7	17%
52.	7086	Financial Education	2006	28	13	46%
53.	7111	Early Childhood Ed. I	2008	21	2	10%
54.	7112	Early Childhood Ed. II	2009	20	1	5%
55.	7121	Culinary Arts & Hospitality I	2005	40	14	35%
56.	7122	Culinary Arts & Hospitality II	2005	27	10	37%
		HEALTH OCCUPATIONS				
57.	7200	Biomedical Technology	2004	38	2	5%
58.	7205	Exploring Biotechnology	2004	37	2	5%
59.	7210	Health Team Relations	2005	31	4	13%
60.	7211	Allied Health Sciences I	2005	59	2	3%
61.	7212	Allied Health Sciences II	2000	33	1	3%
62.	7221	Medical Sciences I	2005	59	1	2%
63.	7222	Medical Sciences II	2002	25	NA	NA
		MARKETING				
64.	6208	Exploring Business Technologies: B & M	2008	22	1	5%
65.	6600	Prin. of Bus. & Personal Finance	2003	46	26	57%
66.	6615	Small Bus. & Entrepreneurship	2003	36	14	39%
67.	6621	Marketing	2006	30	2	7%
68.	6622	Marketing Management	2006	33	6	18%
69.	6626	Strategic Marketing	2008	19	2	11%
70.	6631	Fashion Merchandising	2005	28	2	7%
71.	6645	Travel and Tourism	2004	34	13	38%
72.	6665	Marketing Tech. and Media	2005	39	5	13%
73.	6670	Sports & Entertainment Marketing I	2003	25	1	4%
74.	6671	Sports & Entertainment Marketing II	2004	21	3	14%
		TECHNOLOGY EDUCATION				
75.	8006	Scientific & Tech. Visual. I--TE	2005	24	4	17%
76.	8007	Scientific & Tech. Visual. II--TE	2005	28	3	11%
77.	8011	Principles of Technology I	2001	44	44	100%
78.	8012	Principles of Technology II	2001	41	41	100%
79.	8020	Intro. to Engineering Design (PLTW)	PLTW			NA
80.	8021	Pre-Engineering (PLTW)	PLTW			NA
81.	8022	Digital Electronics (PLTW)	PLTW			NA
82.	8030	Computer Integrated Mfg. (PLTW)	PLTW			NA
83.	8031	Pre-Engineering (PLTW)	PLTW			NA
84.	8032	Pre-Engineering (PLTW)	PLTW			NA
85.	8040	Engineering Design & Dev. (PLTW)	PLTW			NA

	Course #	Course Name	Date of Blueprint	# Obj. in Course	# Math Related Obj.	% Math Related Obj.
86.	8108	Exploring Technology Systems	2002	28	0	0%
87.	8110	Fundamentals of Technology	2003	11	1	2%
88.	8115	Manufacturing Systems	1999	42	14	33%
89.	8121	Principles of Engineering (PLTW)	PLTW			NA
90.	8125	Communications Systems	2005	28	0	0%
91.	8126	Transportation Systems	1999	23	0	0%
92.	8141	Structural Systems	2004	23	4	17%
		TRADE & INDUSTRIAL				
93.	7511	Auto Service Tech. I	2005	37	20	54%
94.	7512	Auto Service Tech II	2005	54	5	9%
95.	7513	Auto Service Tech III	2006	29	26	90%
96.	7521	Collision Repair Tech. I	2006	29	25	86%
97.	7522	Collision Repair Tech. II	2001	66	0	0%
98.	7621	Furniture/Cabinetmaking I	2004	39	4	10%
99.	7622	Furniture/Cabinetmaking II	2004	55	21	38%
100.	7631	Electronics I	2004	35	15	43%
101.	7632	Electronics II	2004	45	15	33%
102.	7641	Metals Manufacturing I	2006	34	13	38%
103.	7642	Metals Manufacturing II	2006	30	17	57%
104.	7661	Welding Tech. I	2005	34	3	9%
105.	7662	Welding Tech. II	2005	46	0	0%
106.	7711	Masonry I	NCCER			NA
107.	7712	Masonry II	NCCER			NA
108.	7713	Masonry III	NCCER			NA
109.	7721	Carpentry I	NCCER			NA
110.	7722	Carpentry II	NCCER			NA
111.	7723	Carpentry III	NCCER			NA
112.	7741	Electrical Trades I	NCCER			NA
113.	7742	Electrical Trades II	NCCER			NA
114.	7811	Cosmetology I	2004	38	6	16%
115.	7812	Cosmetology II	2004	31	12	39%
116.	7821	T & I Coop. Training I	2004	21	7	33%
117.	7822	T & I Coop. Training II	2004	12	6	50%
118.	7901	Scientific & Tech. Visual. I	2005	24	4	17%
119.	7902	Scientific & Tech. Visual. II	2005	28	3	11%
120.	7911	Printing Graphics I	2004	30	2	7%
121.	7912	Printing Graphics II	2004	31	4	13%
122.	7921	Drafting I	2003	26	3	12%
123.	7935	Digital Media I	2009	15	NA	NA
124.	7936	Digital Media II	2009	14	NA	NA
125.	7962	Drafting—Arch. II	2005	30	NA	NA
126.	7963	Drafting—Arch. III	2005	21	0	0%
127.	7972	Drafting—Eng. II	2005	17	NA	NA
128.	7973	Drafting—Eng. III	2005	18	NA	NA
129.	7980	Networking I	2004	32	1	3%
130.	7981	Networking II: Cisco	2004	30	0	0%
131.	7982	Networking III: Cisco	2004	40	3	8%
132.	7983	Networking II: Nortel	2004	30	0	0%
133.	7984	Networking III: Nortel	2004	40	3	8%
134.	7991	Computer Engineering Technology I	2009	27	18	67%
135.	7992	Computer Engineering Technology II	2009	18	10	56%

Math Concepts

Directions: Check off the math concepts found in the CTE courses you teach.

Whole Numbers:

- ☐ Add
- ☐ Subtract
- ☐ Multiply
- ☐ Divide

Fractions:

- ☐ Add
- ☐ Subtract
- ☐ Multiply
- ☐ Divide

Decimals:

- ☐ Add
- ☐ Subtract
- ☐ Multiply
- ☐ Divide

Percentages:

- ☐ Read and write
- ☐ Compute
- ☐ Convert fraction to percent
- ☐ Convert percent to fraction

Ratio and Proportion:

- ☐ Ratio
- ☐ Proportion
- ☐ Direct variation
- ☐ Inverse variation

Customary Measure:

- ☐ Ruler
- ☐ Linear
- ☐ Perimeter
- ☐ Area
- ☐ Volume
- ☐ Weight
- ☐ Capacity
- ☐ Temperature
- ☐ Time

Metric Measure:

- ☐ Length
- ☐ Mass and weight
- ☐ Volume and capacity
- ☐ Time and current
- ☐ Temperature
- ☐ Metric/English conversions

Algebra:

- ☐ Solving linear equations
- ☐ Solving quadratic equations
- ☐ Powers of 10 and scientific notation
- ☐ Systems of equations
- ☐ Substituting data into formulas
- ☐ Graphing linear equations

Geometry:

- ☐ Angles
- ☐ Polygons
- ☐ Quadrilaterals
- ☐ Triangles
- ☐ Similar polygons
- ☐ Circles
- ☐ Prisms
- ☐ Cylinders
- ☐ Pyramids and cones
- ☐ Spheres

Statistics:

- ☐ Charts and tables
- ☐ Bar graphs
- ☐ Line graphs
- ☐ Mean measurement (average)
- ☐ Variance
- ☐ Standard deviation

Trigonometry:

- ☐ Trigonometric ratios
- ☐ Using trigonometric ratios to find angles
- ☐ Using trigonometric ratios to find sides
- ☐ Solving right triangles
- ☐ Application involving trigonometric ratios

Logic:

- ☐ Logic Terms
- ☐ Logic Connectives
- ☐ Logic Quantifiers
- ☐ Logic If-Then statements
- ☐ Math symbols and math sequences

Curriculum Mapping

CTE Course Number _____ CTE Course Name _____

Obj. #	CTE Concepts or Applications	Embedded Math Concepts

Source of Information: National Research Center for Career and Technical Education

Part 5: Using Math in CTE Classes

Whole Numbers: Embedded Examples

Agriculture	All together, the FFA students at Central High School own 40 cows, 12 horses, 25 sheep, and 18 goats. How many animals do the FFA students own?	
Business Strategy # ____	I want to qualify to run Cross Country next semester, but my parents and the coach have told me that I must have at least an average of <u>85 or better</u> in all of my courses this semester in order to join the team. So far my grades in Computer Applications are: 75, 85, 83, 71, and 91. What is my current average in Computer Applications?	
Career Development	An apprenticeship student at Northern High School earned \$470.00 in August, and \$875 in September. How much more did he make in September than he did in August?	
FACS	The FCCLA Chapter at Southern High School had 267 members in 2005, 314 in 2006, 201 in 2007, 298 in 2008, and 320 in 2009. How many members have they had in the last five years?	
HOE	The HOSA Club at Northwest High School raised money for the Children's Hospital. 127 students donated \$2 each, and 261 students donated \$3 each. How much did the HOSA Club raise altogether for the hospital?	
Marketing Strategy # ____	A new flat screen TV costs \$450 in cash. On the installment plan a down payment of \$100 plus 18 monthly payments of \$22.50 is needed. How much is saved by paying cash?	
Tech Ed	There are 30 students in the Principles of Technology class. If the teacher wants to divide the class into six groups to work on special projects, how many students will be in each group?	
T & I	An electrician uses 480 yards of electrical wire in six apartments. If he uses the same amount in each, how much does he use per house?	

More Practice with **Whole Numbers**

Related and Traditional Examples

1.	Dillard's is having a sale on Estee Lauder perfume at \$90 a bottle. How much would you have to pay for 12 bottles?	
2.	A car dealer sold 75 used cars at \$10,995 each. What were his total sales?	
3.	Best Buy sold 234 Blu-Ray Disc Players at \$235 each. How much is the store's total sales of this product?	
4.	If light travels at the rate of 186,000 miles per second, how far does it travel in two minutes?	
5.	If a train travels at an average speed of 70 miles per hour, how far has the train traveled in 14 hours?	
6.	There are 5,280 feet in a mile. If you walked 18 miles, how many feet did you walk?	
7.	In a school yard there are 264 children. How many soccer teams of 11 players each can be formed?	
8.	Vicki earned \$104,000 last year. How much did she earn per week?	
9.	If a rope is 144 inches long, how many yards long is that rope?	
10.	Dell Corporation had a payroll of \$7,500,000 for 864 workers who all earned exactly the same annual pay. How much did each worker earn?	
11.	Sampson, the neighbor's dog, chews up 12,775 bones a year. How many bones does he go through in a day?	
12.	Eric is setting up his new office. He purchased the following equipment: desk (\$499), chair (\$89), computer (\$1,289), and file cabinets (\$76). How much did he spend to furnish his office?	
13.	Sixteen employees in an office went in together to purchase NC Education Lottery tickets and won \$6,000,000. How much will each person receive if they divide their winnings up equally?	
14.	Ted has \$4,762 in stocks and \$2,247 in his bank. How much does he have all together?	
15.	A store in Charlotte takes in \$98,651 on a Saturday. A small branch in Rocky Mount takes in \$33,247. How much more does the Charlotte store take in?	
16.	John is completing his Marketing Co-op experience. He has earned \$8.00 an hour. This month he worked 65 hours. How much did he earn this month?	
17.	Add: $468 + 645$	
18.	Subtract: $7,527 - 149$	
19.	Multiply: 989×67	
20.	Divide: $840 \div 5$	

Part 5: Using Math in CTE Classes

Fractions: Embedded Examples

Agriculture	Marty bought two pigs. Their combined weight was $315\frac{1}{2}$ pounds. If one pig weighed $132\frac{3}{4}$ pounds, how much did the second one weigh?	
Business Strategy # ____	A virus infected Wendy's computer and she lost $\frac{5}{7}$ of the songs she had on her computer. If she is left with 172 songs, how many songs did she have before her computer was infected with the virus?	
Career Development	Brad works for \$6.80 an hour, plus time and a half for all hours over 40. One week he worked 48 hours. What did he earn?	
FACS	Double each of the following ingredients: $\frac{1}{2}$ c. flour $\frac{3}{4}$ c. milk $\frac{1}{8}$ tsp. vanilla	
HOE	At the weight loss center last week, Max lost $3\frac{1}{2}$ pounds, Karen lost $2\frac{7}{8}$ pounds, and Sharon lost $1\frac{3}{4}$ pounds. How much weight did the three of them lose all together?	
Marketing Strategy # ____	If a pizza was cut into 6 equal slices, and you ate 3 of them, what portion of the pizza did you eat?	
Tech Ed	The scale on a blueprint reads $\frac{1}{2}$ " to 1'. If the living room is to be 21' long, how long will it be on the blueprint?	
T & I	How many strips of wood $\frac{5}{8}$ of an inch wide can be sawed off a 5-foot piece of wood?	

More Practice with Fractions

Related and Traditional Examples

1.	How much would it cost to buy $4\frac{2}{3}$ yards of cloth at \$11 per yard?	
2.	Amy and Cheryl went on diets. Together they lost $20\frac{3}{4}$ pounds. If Cheryl lost $12\frac{1}{8}$ pounds, how much did Amy lose?	
3.	If you walked 23 miles at an average speed of $13\frac{1}{4}$ minutes per mile, how long did it take you to walk the entire distance?	
4.	How many $\frac{1}{2}$ pint containers can be filled from a 5-gallon can?	
5.	Farmer Jones bought $7\frac{1}{2}$ bales of hay for \$30. How much did 1 bale cost?	
6.	Janis needs $4\frac{3}{5}$ feet of ribbon to tie a bow around a box. If she only has $3\frac{1}{2}$ feet of ribbon, how much ribbon is she short?	
7.	John worked 14 days out of a 31-day month. What fraction of the month did he work?	
8.	A certain recipe calls for 3 ounces of cheese. What fraction of a 15-ounce piece of cheese is needed?	
9.	Mark had \$10 in his wallet. He spent \$6 for his lunch and left a \$1 tip. What fraction of his money did he spend on his lunch, including the tip?	
10.	If Linda makes \$2,000 a month and pays \$750 for rent, what fraction of her income is spent on rent?	
11.	During a 30-day month, there were 8 weekend days and 1 paid holiday during which Marlene's office was closed. Marlene took off 3 days when she was sick and 2 days for personal business. If she worked the rest of the days, what fraction of the month did Marlene work?	
12.	An outside wall consists of $\frac{1}{2}$ inch of drywall, $3\frac{3}{4}$ inches of insulations, $\frac{5}{8}$ inch of wall sheathing, and 1 inch of siding. How thick is the entire wall, in inches?	
13.	A window is 50 inches tall. To make curtains, Anya will need two more feet of fabric than the height of the window. How many yards of fabric will she need?	
14.	Richard needs 12 pounds of fertilizer but has only $7\frac{5}{8}$ pounds. How many more pounds of fertilizer does he need?	
15.	A computer can burn a CD $2\frac{1}{2}$ times faster than it would take to play the music. How long will it take to burn 85 minutes of music	
16.	How many $2\frac{1}{2}$ pound chunks of cheese can be cut from a single 20-pound piece of cheese?	
17.	Add: $2\frac{3}{4} + 3\frac{1}{6} + 4\frac{1}{12}$	
18.	Subtract: $2\frac{2}{3} - 2\frac{1}{4}$	
19.	Multiply: $\frac{2}{5} \times \frac{3}{4}$	
20.	Divide: $\frac{1}{2} \div \frac{1}{4}$	

Part 5: Using Math in CTE Classes

Decimals: Embedded Examples

Agriculture	Farmer Brown bought 7.5 bales of hay for \$30. How much did 1 bale cost?	
Business Strategy # ____	Joseph had a credit card balance of \$278.24 at the beginning of the month. He bought some clothes for \$135.30 and a TV for \$221.28. At the end of the month, he made a payment of \$350. How much money is needed to pay off his debt completely?	
Career Development Strategy # ____	John's income for this month was \$3,863.65. If John receives his income tax refund of \$165.98 this month and adds that to this month's salary, what will his total income be this month? If John saves 15% of his total income this month, how much will he be able to add to his savings account?	
FACS	At the supermarket, Mary Jo purchased 2.3 pounds of tomatoes, 1.1 pounds of lettuce, a 0.6 pound cucumber, and 4 pounds of carrots. She also decided to buy 1.2 pounds of bananas. How many pounds of produce did Mary Jo buy?	
HOE	A cardboard box can hold a total of 26 pounds. If a bottle of hand sanitizer weighs 0.4 pounds, how many bottles can the box hold?	
Marketing	If Mr. Siegel bought items costing \$3.75, \$2.89, and \$7.05, how much change should he receive from a \$20 bill?	
Tech Ed	If silver wire were sold for 40 cents an inch, how much would it cost to buy 2 yards of wire?	
T & I	One inch is about the same as 2.54 centimeters. Approximately how many centimeters are in a foot?	

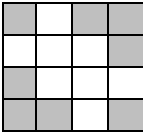
More Practice with Decimals

Related and Traditional Examples

1.	If gold were selling at \$450 an ounce, how much gold could you buy for \$7,875?	
2.	How much change from a \$20 bill would you receive if you bought items costing \$1.75, \$3.39, and \$6.21?	
3.	How much change from a \$50 bill would you receive if you bought items costing \$13.95, \$6.08, and \$24.35?	
4.	At \$2.57 per gallon of gas, what is the cost of 15 gallons?	
5.	Angelica, Ashley, and Aimee go to play miniature golf together. The total bill for their groups comes to \$23.25. If Aimee has a \$10 bill to pay with, how much change should she get back from the other girls once the bill has been paid?	
6.	Melba spent \$117.48 at the grocery store on August 7, \$74.60 on August 15, and \$88.36 on August 24. What is the average amount of money she spent on groceries in these three trips?	
7.	Janice improved her time running a mile in track from 6.3 to 5.66 minutes. By how much time did she improve?	
8.	John loaned Alexis \$70.28 on Friday, and on Saturday, Alexis thanked him by paying him back \$75. How much extra money did Alexis give to John?	
9.	Karin bought three books for \$8.95 each and two magazines for \$1.49 each. How much did she spend in total?	
10.	Jeff runs an average mile in 7.3 minutes when he exercises after work. How many miles has he run after 42 minutes, rounded to the nearest tenth?	
11.	Working at an assembly plant, Audrey made 326 items in five days. How many items did she average per day?	
12.	With the cost of flour at \$4.25 pound, how much do 3.4 pounds cost, rounded to the nearest cent?	
13.	If gasoline costs \$3.92 per gallon, and filling up a car's tank costs \$49.00, how many gallons does the tank hold?	
14.	At \$7.00 per pound, how many pounds of coffee can you get for \$3.15?	
15.	Jodi earned \$22.75 for working 3.5 hours. What was her hourly wage?	
16.	Ronnie deposited three checks in his checking account for the following amounts: \$1,064, \$875, and \$67. He wants \$400 in cash, and will deposit the rest of the money. How much was his deposit?	
17.	Add: $2.32 + 71.4 + 0.003$	
18.	Subtract: $42.63 - 26.58$	
19.	Multiply: 6.2×32.7	
20.	Divide: $92.5 \div 3.7$	

Part 5: Using Math in CTE Classes

Percentages: Embedded Examples

Agriculture	Abe's Apple Farm has a yearly earnings goal of \$86,000. By July, the farm has earned \$27,520. What percentage of their yearly earnings goal has been earned by July?	
Business Strategy # ____	On a bank account of \$1,600, how much yearly interest will be paid if the rate is 5%?	
Career Development	Latoya earns \$24,000 a year. Every month her rent payment is \$680. What percentage of her yearly income does she spend on rent?	
FACS	The cost of a TV recently increased from \$160 to \$200. What was the percent of increase in the price? To compute the percent of increase, find the amount of increase (\$40) and compare this to the original number (\$160).	
HOE	Ninety percent of the 300 dentists surveyed recommended sugarless gum for their patients who chew gum. How many dentists did NOT recommend sugarless gum?	
Marketing Strategy # ____	If a dress is priced at \$129 and sales tax is 8.25%, what is the cost of the dress?	
Tech Ed	Eddie drives a car that gets 45 miles to the gallon when traveling on the highway. If the trip from Phoenix, Arizona, to Denver, Colorado, is 765 miles, and gas costs \$3.59 per gallon, approximately how much will the drive cost Eddie?	
T & I Strategy # ____	What percent of the squares on this figure are shaded? 	

More Practice with Percentages

Related and Traditional Examples

1.	If a state treasury collects \$350,000,000 in tax revenue and then puts \$134,750,000 toward education, what percentage of its revenue is going toward education?	
2.	The cost of a TV recently increased from \$160 to \$200. What was the percent of increase in the price?	
3.	A tire sale advertised 20% off on top-grade belted tires. If the list price for a particular tire is \$80, how much would you have to pay for a set of 4 new tires?	
4.	Because of a new contract, the hourly wage rate was increased by 6%. If the old rate was \$6.50, what is the new rate?	
5.	If a sweater regularly sold at \$45 is marked down 25%, what is the sale price?	
6.	If a color TV regularly sold at \$595 is marked down 20%, what is the sale price?	
7.	On his diet, John's weight dropped from 200 to 178 pounds. What was the percent of decrease in his weight?	
8.	A salesperson works on a 10% straight commission. If her sales for one week were \$2,480, how much did she earn?	
9.	The federal government obtains funding for Social Security by collecting 6.2% of your paycheck from you and another 6.2% from your employer. If your salary is \$300 a week, how much do you pay in Social security tax	
10.	If you were earning \$400 a week and received a \$10 raise, by what percent was your salary increased?	
11.	If your IQ went from 85 to 140 after reading a book, by what percent did your IQ change?	
12.	The Atlanta Braves had a better year in 2006 than they had in 2005. In 2006 they won 70 games; in 2005 they won only 56. By what percentage did their wins increase	
13.	If your pay was cut from \$55,000 to \$52,000, by what percentage did your pay decline?	
14.	If you went on a diet and lost 35 pounds, by what percentage did your weight decline if you now weigh 100 pounds?	
15.	If you left a 15% tip, how much "tip money" would you leave if the price of the meal was \$29.50?	
16.	Janet earned \$78 in tips as a waitress on Friday night. She always puts aside 12% of her tips to pay her taxes at the end of the year. How much should Janet put aside from her Friday night tips?	
17.	Eighteen minutes is what percentage of an hour?	
18.	A store's new Year's Sale is offering 30% off all shoes and bags. If Jo-Anne buys a bag for \$80 and a pair of shoes for \$120, what will her pre-tax total be on her purchase?	
19.	In January the cost of gas for Mr. Smith's farm equipment was \$4.20 per gallon and in October it cost \$3.57. By what percent did the price of gas decrease?	
20.	Multiply: $220 \times 7.75\%$	

More Strategies to Try

Vocabulary Strategy # ____	Recall and describe 5 math terms from your experience with math in high school and/or college.	
Symbols Formulas Equations Problems Strategy # ____	Use words to explain what is meant by this mathematical expression: $y = 3x$ Give an example relating it to a real life situation.	
Using Graphic Organizers to Solve Problems Strategy # ____	During the winter, Cole spent \$200 on entertainment, cashed in a savings bond worth \$300, paid rent of \$650, paid \$200 in school expenses, earned \$350 in wages and overtime, received \$600 from his scholarship, and paid utilities totaling \$150. What was Cole's total income, expenses, and net gain or loss?	
Writing in Math Strategy # ____	Write a sentence to describe similarities and differences among the following math terms and/or concepts: Parabola, slope and equation	
Math Terms and Concepts Strategy # ____	List characteristics, attributes, related words/ideas, and examples to describe what you know about polynomials.	

Part 6: The Math-in-CTE Model

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The Seven Elements of a Math-Enhanced Lesson

1. Introduce the CTE lesson.
2. Assess students' math awareness as it relates to CTE.
3. Work through the math example **embedded** in the CTE lesson.
4. Work through **related, contextual** Math-in-CTE examples.
5. Work through **traditional math** examples.
6. Students demonstrate their understanding.
7. Formal assessment.



Source of Information: Math-in-CTE, National Research Center for Career and Technical Education

The Math-in-CTE Lesson Planning Guide

1. Introduce the CTE lesson.

- Explain the CTE lesson.
- Identify, discuss, point out, or pull out the math embedded in the CTE lesson.

2. Assess students' math awareness as it relates to the CTE lesson.

- During assessment, introduce math vocabulary through the math example embedded in the CTE lesson.
- Employ a variety of methods and techniques for assessing all students' awareness (e.g., questioning, worksheets, group learning activities)

3. Work through the math example embedded in the CTE lesson.

- Work through the steps or processes of the embedded math example.
- Bridge the CTE and math language. The transition from CTE to math vocabulary should be gradual throughout the lesson, being sure never to abandon either set of vocabulary completely once it is introduced.

4. Work through related, contextual math-in-CTE examples.

Using the same math concept embedded in the CTE lesson,

- Work through similar problems/examples in the same occupational context.
- Use examples with varying levels of difficulty; order examples from basic to advanced.
- Continue to bridge CTE and math vocabulary.
- Check for understanding.

5. Work through traditional math examples.

Using the same math concept as in the embedded example and the related, contextual examples,

- Work through traditional math examples, as they may appear on standardized tests.
- Move from basic to advanced examples.
- Continue to bridge CTE and math vocabulary.
- Check for understanding.

6. Students demonstrate their understanding.

- Provide students with opportunities for demonstrating their understanding of the math concepts embedded in the CTE lesson.
- Relate the math examples back to the CTE content; conclude the lesson on the topic of CTE.

7. Formal assessment.

- Incorporate math questions into formal assessments at the end of the CTE unit/course.

Source of Information: Math-in-CTE, National Research Center for Career and Technical Education <http://www.nrccte.org/>

The Math-in-CTE Lesson Plan Example

Subject: *Carpentry*

Lesson Topic: *90 Degree Square Corners*

1	The teacher points out that the carpenters (students) must ensure 90-degree (square) corners on their building project.
2	The teacher assesses students' awareness as it relates to CTE
3	The teacher walks through the original problem of ensuring a wall frame's rectangular shape, gradually introducing the math formula and terminology of the Pythagorean Theorem. The teacher uses both math and CTE vocabulary.
4	Students solve other construction problems to which the Pythagorean Theorem can be applied.
5	Students solve traditional math problems using the Pythagorean Theorem.
6	Students demonstrate their understanding.
7	Students complete the building project as well as a worksheet practicing the Pythagorean Theorem in CTE and traditional math problems. The concept is repeated as appropriate throughout the course, and students are asked to demonstrate their understanding on a unit test at a later date.

The Pythagorean Theorem

In any right triangle, the area of the square whose side is the hypotenuse (the side opposite the right angle) is equal to the sum of the areas of the squares whose sides are the two legs (the two sides that meet at a right angle.)

The theorem can be written as an equation: $a^2 + b^2 = c^2$

Source of Information: Math-in-CTE, National Research Center for Career and Technical Education
<http://www.nrccte.org/>

The Math-in-CTE Lesson Planning Template

Steps	Activities
<u>Introduce</u> the CTE lesson	
<u>Assess</u> students' math awareness as it relates to the CTE lesson	
Work through the math example <u>embedded</u> in the CTE lesson	
Work through <u>related, contextual</u> Math-in-CTE examples	
Work through <u>traditional</u> math examples	
Students <u>demonstrate</u> their understanding	
Formal <u>assessment</u>	

Source of Information: Math-in-CTE, National Research Center for Career and Technical Education
<http://www.nrccte.org>

Part 7: What Can CTE Teachers Do?

1. Be a good role model. Showcase the way you use mathematics in your professional life as well as your specific content area.
2. Make mathematics an integral part of daily instruction. Strive to make a connection during each class.
3. Provide time in class for students to work on mathematics that related to instructional objectives for your content area.
4. Incorporate logical reasoning and problem solving opportunities daily, as it relates to your content.
5. Provide resources for students such as calculators, rulers, scale models, graphic organizers, charts, graphs, statistical data, etc., to enable students to experience mathematical connections to various topics across the curriculum.
6. Create and/or gather samples of mathematical connections to your specific content area. Share newspaper articles, magazine articles, and professional journal articles that show how mathematics is utilized in your academic discipline.
7. Allow students choice about their completion of assignments that incorporate mathematics and problem solving.
8. Invite students to incorporate data and data analysis as part of writing to authentic audiences for authentic reasons about which they truly care.
9. Provide students with prompt feedback about content as well as mathematical reasoning when appropriate.
10. Avoid teaching computation in isolation. It should be addressed in the context of students' own authentic problem solving.
11. Analyze student work to determine instructional implications and make adjustments in instruction to address areas of need.
12. Look at student work with an eye for logical reasoning, use of multiple representations, incorporation of data, and use of graphs that make cross curricular connections.
13. Read professional literature about incorporating mathematic concepts into your specific content area.
14. Focus on improving each student's knowledge and ability to apply mathematical thinking and reason skills across content areas rather than just developing computational skills in isolation.
15. Avoid sharing any personal "math phobias" or a personal dislike of mathematics. Educators never boast of being illiterate, yet we often freely share that were are innumerate!

Source: Adapted from SREB, 2003

Overcoming “Math Anxiety”

Career and Technical Education (CTE) teachers have a lot on their plate when it comes to delivering their core curriculum. With the emphasis on integrating academic math in the CTE curriculum, CTE teachers may be feeling a bit overwhelmed by this new challenge.

But fear not! Here are a few techniques that may help you deliver the math component of your lab curriculum in a way that is easier for you to teach and your students to understand. There are a few things to keep in mind when teaching math that will make teaching it less stressful for you and your students.

The first is that math is a difficult subject to teach, even for math teachers. The subject matter itself is challenging.

The second is that math is a head trip. By this I mean that unlike other curriculum, math has a built-in fear factor. Many students and teachers have some level of math anxiety.

At the root of this anxiety is a lack of confidence in one's ability to do the math. In order to build your confidence to teach math, take the time to understand the underlying math concepts you will be teaching your students.

Instilling confidence in your students that they can learn trade-related math is the first step to success. Developing this confidence is an important part of teaching and learning math. If students are apprehensive about math, they will not be receptive to your CTE-related math lessons, and teaching them will be difficult if not impossible.

Most students who lack confidence in their ability to do math will hide their anxiety by saying “this stuff is useless,” or, “why do I have to learn this?”

Your number one goal is to build up their confidence. Just as you work with your students to build their trade skills, you will need to help build their math skills.

Skills You Need to Teach Math Successfully

First of all, you have to become an expert in the math needed to be successful in your trade. You need to know your math so well that it is now second nature to you.

Unfortunately, quite often when one is asked to explain what they are doing, they freeze like a deer in the headlights.

I know the math but how do I teach it? One suggestion is to seek out a math teacher in your school or from one of your sending schools and go over the math you will be teaching with that teacher. Ask the math teacher for tricks of the trade in delivering these concepts.

Just as a master in your trade showed you the tricks of the trade, so too math teachers can help you learn the tricks in teaching math. We were not born masters of our trade—we had to be taught.

The most important skill in teaching math is to have confidence in your ability to teach it. Many students are apprehensive about math just as you may be.

What you project will be picked up by your students. If the student is the least bit anxious about math and their ability to do well in it, they will be looking for an excuse to avoid doing the work.

If they have a glimmer that you also do not find it useful or enjoyable, they will exploit this as a justification for them to not put the effort into learning it. They can sense if you are feeling dicey about math. If you feel confident, they will too. The goal is to lower the students' apprehension and help them feel comfortable and capable.

Build up your students' confidence. Help them realize that they can do it, that they have the natural ability to understand the concepts. Do this by showing how they may already be using these math concepts in their lab.

Source: TECHNIQUES, March 2009

Points to Remember When Teaching Math

1. Assume students may not have the background to do the math.
2. Review basic math concepts with them.
3. Let nothing be overlooked. The devil is in the details. Every step, even the simplest concept, is important. What you take for granted may be a stumbling block to your students.
4. Going over basic math in the context of your trade may allow for greater understanding of the underlying math concepts. Even basic math concepts can be deep. Math is taught in a spiral. Concepts are introduced in elementary school and then revisited in middle school and again in high school, each time going a little deeper. So going over these basic math concepts in the context of your trade may help students reach a deeper understanding of concepts they did not grasp in the academic setting.
5. Honor the student for bringing their questions to the class. Don't put a student down for not know how to do basic math. Use a student's lack of understanding as a jumping-off point to re-teach the skill to the class. When one student asks a question or doesn't know a concept you can bet there are others who are in the same boat.
6. Listen to the students' responses to your questions. They may have the right answer but in a form you were not anticipating. Take a moment to analyze their answers. Try to understand where they are coming from and what their reference points are.

For example, a student may say the size of the socket wrench needed to do a job should be $\frac{4}{8}$ instead of the answer you were expecting of $\frac{1}{2}$. Be careful when you correct the student. Sometimes when the teacher says the answer is wrong the student may immediately believe the thinking is wrong. Remember students may not have developed the balance that adults have. They may take things to heart and believe they did not grasp the concept or they may think they are "stupid" when in fact their thinking and abilities are on target.

In the example above, the student did understand the concept. The student did have the right wrench size, but the answer was not presented in standard form. So let students know when their logic is sound but that they may have made a "computational mistake."

7. Walk students through every step of the problem or process while checking along the way for comprehension and eliminating any confusion.
8. Remind students that math is hard work and that learning math is a workout for the mind like sports is a workout for the body. Math makes you think, and thinking hurts!
9. In order to be successful in math, students need to practice just as practice is needed to master the skills of their trade.
10. When a student finds that he just can't seem to solve a math problem (incidentally this will work for trade-related problems too), instead of having him beat himself up, offer some advice. Have her get up and walk away or do something else.

This allows the mind to relax and let the creative part of the mind take over. While the student has diverted attention to other things, the mind is still working on the problem in the background, perhaps making connections in novel ways. Oftentimes when the student returns to the problem, the solution is right in front of her. If students still cannot find the answer, have them put it aside and ask for help.

Source: TECHNIQUES, March 2009

Tips for Improving Numeracy

Numeracy remains a daunting challenge. For each person who never learned to read, there must be a hundred who boast that “I never was any good at math.” That imbalance is especially troublesome in an age of data and measurement, of computers and statistics. Changing school mathematics is an important ingredient in any program for reform, but one must also look to society beyond the schools for serious change of lasting benefit. Here are some small but important changes that would make great improvement in numeracy:

1. *Don't teach just arithmetic.* Numeracy requires a rich blend of statistics, geometry and arithmetic, catalyzed by careful reasoning rooted in common sense.
2. *Don't rely on worksheets.* Students learn best in active contexts featuring discussion, writing, debate, investigation, and cooperation. Isolated facts on artificial worksheets reinforce the image of school mathematics as totally artificial and unrelated to real life.
3. *Don't ignore calculators.* Children must learn many ways to calculate—manually, mentally, electronically—in realistic contexts that reflect the world around them. Calculators are part of that world, and should be part of school mathematics.
4. *Don't rely only on school.* Children are influenced as much by the entertainment and sports industries as by formal school instruction. There is much that those industries could do to promote both numeracy and literacy.
5. *Don't use just short-answer tests.* Assessment instruments sternly influence the shape of instruction and learning. In numeracy, as in literacy, formulation and expression are as important as “answers.” Tests should reveal how students think, not just what they know.
6. *Don't depend only on mathematics.* Although numeracy may be taught in mathematics classes, to be learned effectively it must be used widely in other contexts, both in school, at home, in entertainment, and in sports.

Source: Numeracy, Lynn Arthur Steen, St. Olaf College

Reading in Mathematics

Develop the habit of careful reading in mathematics. Do not be alarmed if your reading rate is slow—it should be. Often you must reread a mathematics problem to be sure that you understand. As you read carefully you will be looking for the answers to these questions:

1. What is given? (the facts in the problem)
2. What is unknown? (the answer to be found)
3. How do I proceed? (the methods or steps to solve the problem)

This is a different style of reading from the one you might use in looking through a newspaper or magazine. In mathematics directions and problems are compressed into very few words. The use of symbols and numerals further reduces the number of words. Therefore each word or symbol becomes very important and should not be missed by speedy reading.

As in any subject, your reading in mathematics improves as you learn more terms and symbols. Further, the reading of mathematics requires close attention to relationships. How does one fact or idea lead to another? Which facts or ideas are connected?

Source: BARRON's E-Z MATH, Anthony and Katie Prindle



Study Tips for Your CTE Students

1. **Start with a goal.** Study because you want to learn. As an adult you make your own choice that study is important to your progress.
2. **Make the conditions help you, not distract you.** The place, the furniture, the lighting, and the temperature should not interfere with study.
3. **Organize your materials.** Usually these are the book you are using, the pencils or pens to make notes, and paper or a notebook. Get these ready before you start so that you do not waste your time looking for each item.
4. **Begin.** The greatest enemy of study is the tendency to delay or postpone. Try to set aside a definite time each day so that you are used to studying then.
5. **Survey.** Look over quickly what you plan to do. Get a general idea so that your efforts are directed to that goal.
6. **Take time to think.** Relate the ideas you learn to your previous knowledge.
7. **Make notes.** By writing down the key ideas or main rules, you help yourself to learn them. The notes are useful for review at a later time. You can also use notes to list comments or questions which are not clear, so that you remember to ask for help or explanation.
8. **Be reasonable in your study time.** Most human beings cannot work long hours without an occasional break. On the other hand long breaks and short study time will cover very little.
9. **Be fair in rating yourself.** You cannot expect to be perfect. Give yourself a chance to improve or make progress.
10. **Review.** Ideas slip away if you do not refer to them again. Review by reading your notes, looking at main headings, or asking yourself questions about the material.
11. **Use what you learn.** Practice your mathematical skills in shopping, purchasing, or working.

Special Study Hints for Mathematics

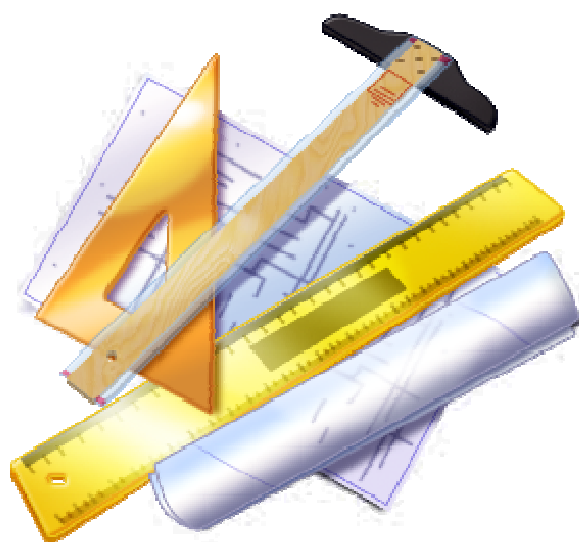
12. Look through the material (a section or chapter) to get a general idea of the topic.
13. Note especially any new terms or symbols and their explanations.
14. Read the instructions and explanations before working any problem.
15. Concentrate on why (the reasoning which governs the problem) and how (the method or process to solve the problem).
16. Follow the order or sequence of steps given in the examples.
17. Consider why you did each step. (In other words, you should be able to explain your reason for doing the work that way.)
18. Use practice problems to check whether you have learned the reasoning (why) and the method (how) for that type of problem.

Source: BARRON's E-Z MATH, Anthony and Katie Prindle

Part 8:

Tools for Teaching

Numeracy



Glossary of Numeracy Strategies

	Strategy	Description
1	Alpha Math	Using an Alpha Math organizer, students recall math terminology associated with math concepts they have studied. Students then use the list to recall and/or describe each term or concept.
2	Agree or Disagree	Prior to being introduced to new material, students are given facts and figures to classify and are asked to Agree or Disagree with the statement or data. At the end of the lesson, students review their answers to determine if they want to revise their responses based on new information.
3	Chunking	Chunking is a strategy used to organize complex mathematical problems into smaller “chunks” of information that can be more easily processed. By making the amount of information to be learned at one time more manageable, students are able to be more successful with multi-step problems and multi-faceted analyses.
4	Fact or Inference	Fact or Inference is a strategy used for clarifying the accuracy of what we know---or <u>think</u> we know. When students identify something that they already <u>know</u> about a mathematical problem, they are often simply drawing an inference or making an assumption. Since many inferences are incorrect, students may need to open their minds and recognize that something they thought they knew is not correct after all.
5	Good, Better, Best	Good, Better, Best is a numeracy strategy that requires the student to think of more than one way to solve a problem. The student brainstorms ways to solve the problem, and looks at the process involved. The student then classifies the strategies as “good”, “better” or the “best” way to solve the math problem.
6	K-W-C	K-W-C is a strategy used during the problem solving process. It allows students to filter the information they already Know about a problem, What they Want or need to know about the problem, and the rules or Conditions they need to apply.
7	Mathematically Speaking	Mathematically Speaking is a strategy that is based on research findings that the best learning method to increase retention is to teach someone else. Teaching someone else may be done by expressing ideas or methods in one’s own words, thereby, clarifying and reinforcing one’s own understanding.
8	Math-to-Life Connections	To make a Math-to-Life Connection is to see a relationship between a math concept and a real-life situation. Finding Math-to-Life Connections greatly increases the relevance of new information and skills being learned.
9	Math-to-Self Connections	To make a Math-to-Self Connection is to see a relationship between a math concept and one’s own prior learning or experience. Finding Math-to-Self Connections helps to make meaning and increase the relevance of new information or skills that need to be learned.
10	Math Rewrites	Have students do Math Rewrites to clarify the meaning of symbols in mathematical formulas, equations, and problems. Have them replace all numbers and symbols with words. This helps them make sense of the total formula, equation, or problem. When modeling Math Rewrites and when having student do Math Rewrites , remember that the more detailed the rewrite, the better. One way to reinforce the need for detail is to award bonus points to students who provide the most details in their Math Rewrites .

Glossary of Numeracy Strategies, continued

	Strategy	Description
11	Mental Calculating	Mental Calculating is a strategy that helps students build their thinking skills and their sense of numerical relationships by doing math “in their heads.” Begin by teaching students to estimate the answer so that once they solve the problem, they will know if their answer seems reasonable.
12	Physical Representations	Through Physical Representations , students use manipulatives to identify connections and recognize patterns. Manipulatives may include a wide variety of objects, including, but not limited to: blocks, coins, bills, marbles, chips, food slices, toothpicks, stones, shells, or noodles.
13	Pictorial Representations	Through Pictorial Representations , students draw pictures of diagrams or construct lists, tables, or graphs in order to identify connections, recognize patterns, and build meaning. Pictorial Representations may be done by hand or by computer and range from very simple diagrams to complex, multi-dimensional drawing.
14	RAMMP	RAMMP is an acronym for Role-Audience-Medium-Math Problem R is the Role the writer is assuming (person or thing) A is the Audience for whom the text is written M is the Medium of communication the writer is supposed to use MP is the Math Problem you are supposed to discuss or explain A RAMMP helps students see the relevance of math operations in communicating with individuals in real-life situations.
15	Scaffolding	Scaffolding means building understanding layer by layer. It involves teaching foundational skills so that the next highest level of understanding can be achieved. When scaffolding is successful, students are able to combine basic skills to accomplish more complex tasks.
16	Stop and GO	Stop and GO is a numeracy strategy that reminds students to stop and interpret information before trying to solve math problems. After students read a problem containing various items of numerical information, they “ Stop and Graphically Organize ” the information. There is no single correct way to organize; approaches vary from one student to another. Students should use any format that seems to work well with the types of information in the problem. The important thing to remember about Stop and GO is that many students will need to be encouraged to stop and do a graphic organizer when they do practice problems in class so they will remember to use this strategy on their own when taking tests.
17	Think-Solve-Pair-Share	The Think-Solve-Pair-Share strategy allows students to work in groups of two. Each student works the problem, and then they take turns sharing their work with each other.
18	3 x 3 Chart	After learning new math terminology, students use the words in the 3 x 3 Math Chart to write sentences using the words in each row and in each column. (6 sentences using words in Rows 1,2,3 and Columns 1,2,3) This strategy requires the students to describe similarities and/or differences among math terms and related concepts.
19	Track Your Thinking	The Track Your Thinking strategy provides students with a way of keeping track of the steps they take as they reason through a math problem to reach a solution. Encourage students to write down each mental calculation they do, step by step, no matter how simple or automatic the step may be.
20	Word Splash 4 Math	Word Splash 4 Math requires the students write a key term or concept inside a circle. Around the circle they describe the key term or concept by listing characteristics, attributes, related words/ideas, and examples to show what they’ve learned.

1. Alpha Math

Description:	Using an Alpha Math organizer, students recall the terminology associated with math concepts they have studied. Students then use the list to recall a definition of each concept.
Revised Bloom's Taxonomy Category & Cognitive Process:	Remember (A1)
RBT Subcategory:	Recall

Math Topic: Cumulative Math Concepts and Terminology

A absolute value algorithm angle area array average	B base bisect	C calculation chord circle coefficient collinear combination composite number congruent constant correlation	D decimal deductive reasoning denominator diagram diameter difference dimension domain
E equation exponent expression	F fact factor factorial fractions frequency distribution function	G graph	H height hypotenuse
I inductive reasoning inference integer interest rate inverse irrational number	J justify	K known	L limit line linear logarithm
M manipulative math vocabulary chart mean median mode	N numeracy numerator	O obtuse angle	P parabola pattern percentage perimeter polynomial proportion
Q quadratic quadrilateral quotient	R radius ratio rational expression rectangle remainder	S scale factor similar slope square sum	T table triangle

2. Agree or Disagree

Description:	Prior to being introduced to new material, students are given facts and figures to classify and are asked to Agree or Disagree with the statement or data. At the end of the lesson, students review their answers to determine if they want to revise their responses based on new information.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Classify

Math Topic: Data Classification

Part I: Directions: Read each statement before the lesson begins. In the “Before Column” indicate whether you agree or disagree with each statement. If you disagree, use a “+” to indicate you believe it is more; use a “–” if you believe it is less than the stated amount.

BEFORE		Statement	AFTER	
Agree	Disagree + or –		Agree	Disagree
		27% of eighth-graders cannot correctly shade $\frac{1}{3}$ of a rectangle.		
		45% of eighth-graders cannot solve a word problem that requires dividing fractions.		
		58 % of adults cannot calculate a 15% tip for a lunch bill.		
		71% of adults cannot calculate miles per gallon on a trip.		
		78% of adults cannot explain how to compute the interest paid on a loan.		

Part II: Directions: After the material has been presented, review each statement again to see if you still agree with your original responses.

3. Chunking

Description:	Chunking is a strategy used to organize complex mathematical problems into smaller “chunks” of information that can be more easily processed. By making the amount of information to be learned at one time more manageable, students are able to be more successful with multi-step problems and multi-faceted analyses.
Revised Bloom’s Taxonomy Category & Cognitive Process:	Analyze (B4)
RBT Subcategory:	Organize

Math Topic: Cash vs Credit

Problem: A new flat screen TV costs \$450 in cash. On the installment plan a down payment of \$100 plus 18 monthly payments of \$22.50 is needed. How much is saved by paying cash?

First Chunk: Multiplication	$ \begin{array}{r} \$ 22.50 \text{ (amount of monthly installment payments)} \\ \times 18 \text{ (number of months payments to be made)} \\ \hline \$405.00 \text{ (total amount of monthly payments)} \end{array} $
Second Chunk: Addition	$ \begin{array}{r} \$405.00 \text{ (total amount of monthly payments)} \\ +100.00 \text{ (amount of down payment)} \\ \hline \$505.00 \text{ (total cost of TV on “installment plan”)} \end{array} $
Third Chunk: Subtraction	$ \begin{array}{r} \$505.00 \text{ (total cost of TV on “installment plan”)} \\ - 450.00 \text{ (cash price)} \\ \hline \text{\$ } 55.00 \text{ (amount you would save by paying cash)} \end{array} $



4. Fact or Inference

Description:	Fact or Inference is a strategy used for clarifying the accuracy of what we know---or <u>think</u> we know. When students identify something that they already <u>know</u> about a mathematical problem, they are often simply drawing an inference or making an assumption. Since many inferences are incorrect, students may need to open their minds and recognize that something they thought they knew is not correct after all.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Compare

Math Topic: Fractions

What I Think I Know (Assumption or Inference)	The Facts
Shade $\frac{1}{3}$ of this rectangle. 	To be accurate you will need to measure and be sure it is one-third of the total length of the rectangle.



5. Good, Better, Best

Description:	Good, Better Best , is a numeracy strategy that requires the student to think of more than one way to solve a problem. The student brainstorms ways to solve the problem and looks at the process involved. The student then classifies the strategies as “good”, “better”, or the “best” way to solve the math problem.	
Revised Bloom’s Taxonomy Category & Cognitive Process:	Understand (B2)	Evaluate (B5)
RBT Subcategory:	Exemplify	Critique

Math Topic: Tipping/Calculating Percentages

Introduction: For most math problems, there are several ways to find a solution. The purpose of this activity is to provide practice in thinking of multiple ways to solve problems.

Directions: Think OUTSIDE the box to think of at least 3 ways to solve the problem below. Then show each approach INSIDE the boxes below. Finally, evaluate solutions to decide which solution you think is the “best” way to solve the problem. Label your answers as “good, better, and best”. Be prepared to justify your rankings.

Problem: Greg wants to leave a 15% tip on a \$35 meal. How much should he leave?

Good	Better	Best!

5. Good, Better, Best---Notes to Teachers

This page is “For Teachers Only” and is designed to help teachers support students as they complete the “Good, Better, Best” activity. Do not duplicate this page for students.

Math Topic: Tipping/Calculating Percentages

Directions: Think OUTSIDE the box to think of at least 3 ways to solve the problem below. Then show each approach INSIDE the boxes below. Finally, evaluate solutions to decide which solution you think is the “best” way to solve the problem. Label your answers as “good, better, and best”. Be prepared to justify your rankings.

Problem: Greg wants to leave a 15% tip on a \$35 meal. How much should he leave?

Note 1. Finding Multiple Solutions (exemplify)

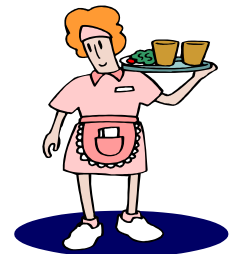
See below 4 sample ways to solve this problem. Without directly showing students these solutions, prompt students, give clues, ask questions, and provide feedback to help them open doors in their thinking and arrive at their own solutions. Keep in mind that there are several other approaches to solving the problem that could be used that are not represented here. It might also be helpful to have students pair up and talk about their ideas for solving the problem before they begin working on their own.

Sample Ways to Solve the Problem:

1. *You could calculate 15% of 35. ($35 \times .15 = \$5.25$)*
2. *Another way to figure the tip is to determine 10% of the cost of the meal. (\$3.50)
Find half of that amount. (\$1.75)
Then add the two together: ($3.50 + 1.75 = \$5.25$)*
3. *An even simpler way is to double the amount of the tax.
Since the current tax rate is .0775 the tax on the check should be \$2.71.
That is about half of 15%, so if you simply double the amount of the tax, it would be about the same amount. ($2.71 + 2.71 = \$5.42$)*
4. *One more way: Use the E-Z Tip Calculator on your cell phone!*

Note 2. Rating Solutions (evaluate)

After students label their solutions as “good, better, and best,” ask them to comment on reasons for their choices. Observe that some may have based their ratings on speed, others on level of difficulty, convenience, or other factors. See if students can reach consensus as to which solution is “Best All-Around”---that is, the fastest, simplest, most convenient way of solving the problem.



6. K-W-C

Description:	K-W-C is a strategy used during the problem solving process. It allows students to filter the information they already Know about a problem, What they Want or need to know about the problem, and the rules or Conditions they need to apply.
Revised Bloom's Taxonomy Category & Subcategory:	Analyze (B4)
RBT Subcategory:	Differentiate

Math Topic: Fractions

Problem: A virus infected Wendy's computer and she lost $\frac{5}{7}$ of the songs she had on her computer. If she is left with 172 songs, how many songs did she have before her computer was infected with the virus?

What do I <u>know</u> for sure?	What do I <u>want</u> to do, figure out, find out?	Are there any special <u>conditions</u> , rules, or tricks I have to watch out for?)
I know for sure that: She lost $\frac{5}{7}$ of her songs. She has 172 songs remaining on her computer. So if she lost $\frac{5}{7}$, then the songs she has left (172) represents $\frac{2}{7}$ of what she had originally.	I want to find out: How many songs she had before her computer was infected. 	Conditions, rules, tricks: You cannot solve this problem until you know what $\frac{1}{7}$ of the songs would be.

Solution:

If $\frac{2}{7}$ equals 172, then $\frac{1}{7}$ must equal 86.

Answer: $86 \times 7 = 602$

7. Mathematically Speaking

Description:	Mathematically Speaking is a strategy that is based on research findings that the best learning method to increase retention is to teach someone else. Teaching someone else may be done by expressing ideas or methods in one's own words, thereby, clarifying and reinforcing one's own understanding.
Revised Bloom's Taxonomy Category and Cognitive Process:	Understand (B2)
RBT Subcategory:	Interpret

Math Topic: Sales Tax

Directions: Working with a partner, discuss what you know about sales tax and its impact on the cost of merchandise.

Example: *When you pay sales tax, you never have to worry about calculating it because that's the job of the seller. But you're the one who pays the tax.*

In fact, most people don't even pay attention to how much they're paying for the good or service and how much they're being charged in sales tax.

In New York City, for example, there's a sales tax of 8 ¼ % on most items---clothing, restaurant meals, books, furniture, and even movie admission. In New Jersey, just across the river, they charge only 5%, and clothing is tax exempt. So maybe it pays to drive over to New Jersey to shop at Daffy Dan's or at SAM's. Not only do you save on your sales tax, but you can pick up some real bargains!

Problem: If a dress in Bloomingdales' was priced at \$129, and Daffy Dan's had the same dress for \$89, how much would you save by shopping at Daffy Dan's?

Example: Did you say \$40? Better guess again! You would save even more, because you need to figure out the sales tax that you would have paid in New York (8¼%!). Remember in New Jersey, there is no sales tax on clothing!

Solution:	$ \begin{array}{r} \$129 \\ \times .0825 \\ \hline 645 \\ 258 \\ \hline 1032 \\ \hline \text{Tax in NY} \quad \$10.6425 \end{array} $	
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Answer: You would be saving \$10.64 in tax, in addition to the \$40 price difference. So you would save a total of \$50.64. On the other hand, you would have to pay for gas and tolls, which could end up costing more than \$50.64!

8. Math-to-Life Connections

Description:	To make a Math-to-Life Connection is to see a relationship between a math concept and a real-life situation. Finding math-to-life connections greatly increases the relevance of new information and skills being learned.
Revised Bloom's Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Category:	Implement

Math Topic: Estimation of Earning Power¹

Problem: Follow the steps below to estimate how much a person would earn during a typical number of working years for a specific type of career.

(Answers will vary)

Earning Power Directions: Record information in the appropriate spaces at the below. Select a career goal to answer the question "What do you want to be when you grow up?" Career Goal: _____ Research online to find out how much money a person working in this career typically earns in one year. Expected Yearly Earnings: _____ Estimate the maximum number of years you will probably work between the time you complete your education and the time you expect to retire. Number Years to Work: _____ Use this information to estimate the amount of earnings you could earn in a lifetime if you were to pursue this career. Estimated Lifetime Earnings: _____	 Make a list of factors that could cause your total earnings to be less or more. Factors that could lessen earnings: _____ _____ _____ _____ _____ Factors that could increase earnings: _____ _____ _____ _____ _____
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¹ 7086 Personal Finance, Appendix 1.01D, Summer 2010

9. Math-to-Self Connections

Description:	To make a Math-to-Self Connection is to see a relationship between a math concept and one's own life experiences. Finding math-to-self connections helps make meaning and increases the relevance of new information and skills that need to be learned.
Revised Bloom's Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Category:	Execute

Math Topic: Averages

Math-to-Self Connection: I want to qualify to run Cross Country next semester, but my parents and the coach have told me that I must have at least an **average** of 85 or better in all of my courses this semester in order to join the team.

Problem: Halfway through the first semester in Computer Applications, I have scored 75, 85, 83, 71, and 91 on tests.

- 1) Based on these five test scores, what is my current average in the course?
- 2) If this grade were my final semester grade, would I be able to join the team?
- 3) What will my average score for the second half of the semester need to be in order to earn a final grade of 85 and be able to join the team?
- 4) How much do I need to pull up my test scores for the rest of the semester in order to qualify for Cross Country, and what should be my goal score for each test?

Solution:

$$1. \ 75 + 85 + 83 + 71 + 91 = 405 \qquad 405 \div 5 = \mathbf{81}$$

2. No

$$3. \ 85 \times 2 = 170 \qquad 170 - 81 = \mathbf{89}$$

$$4. \ 89 - 81 = \mathbf{8}$$

Math-to-Self Connection: If I want to run Cross Country, I must pull up my grades on average 8 or more points per test. My goal for each test needs to be a score of 89 or above.



9. More Math-to-Self Connections

Description:	To make a Math-to-Self Connection is to see a relationship between a math concept and one's own life experiences. Finding math-to-self connections helps make meaning and increases the relevance of new information and skills that need to be learned.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Category:	Interpret

Math Topic: Calculating Miles Per Gallon

Problem:

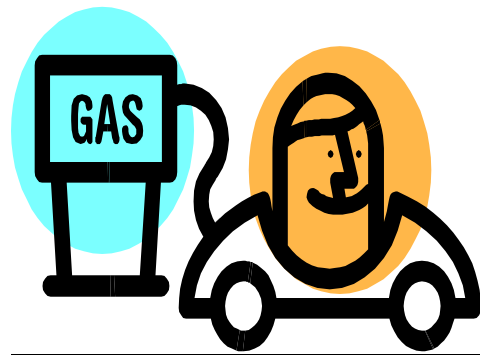
Eric thinks he is spending a lot of money on gas these days. He is trying to decide if he should purchase a new car that gets 30 miles per gallon. He needs to know what kind of fuel mileage he is getting with his old car before he can make that decision.

He has just returned from a long trip, and when Eric left home the odometer on his car read 32, 416 miles. When he arrived at his destination it read 33,027. How many miles had he traveled?

$$\begin{array}{r} 33,027 \\ - 32,416 \\ \hline 611 \end{array}$$

If he used 47 gallons of gas, how many miles per gallon did he get?

Answer: $611 \div 47 = 13$ miles per gallon



10. Math Rewrites

Description:	Have students do Math Rewrites to clarify the meaning of symbols in mathematical formulas, equations, and problems. Have them replace all numbers and symbols with words. This helps them make sense of the total formula, equation, or problem. When modeling Math Rewrites , and when having students do Math Rewrites , remember that the more detailed the rewrite, the better. One way to reinforce the need for detail is to award bonus points to students who provide the most details in their Math Rewrites .
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Interpret

Math Topic: Algebraic Expressions

Directions: What does this mathematical expression mean? $y = 3x$

Interpret its meaning by using words to change the numerical express to a verbal one.

Rewrite: For every x-value, the y-value is three times as much.

Relevant Example for Class Discussion:

- There are three wheels on a tricycle.
- If I have 1 tricycle, I will have 3 wheels.
- If I have 2 tricycles, I will have 6 wheels.
- For 10 tricycles, I will have 30 wheels.
- In general, for x tricycles I will have $3x$ wheels, where x = the number of tricycles and y = the number of wheels.



11. Mental Calculating

Description:	Mental Calculating is a strategy that helps students build their thinking skills and their sense of numerical relationships by doing math “in their heads.” Begin by teaching students to estimate the answer so that once they solve the problem, they will know if their answer seems reasonable.
Revised Bloom’s Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Subcategory:	Execute

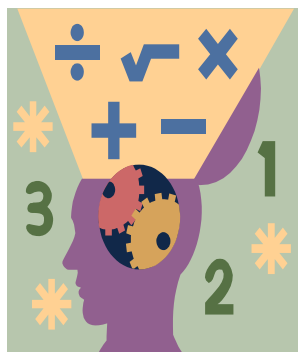
Math Topic: Computing Interest

Problem:

How much interest would Wendy be charged on a loan of \$1,000 with an interest rate of 5.5%?

Mental Calculations:

1. In your head, convert 5.5% to .055 by dropping the percent sign and moving the decimal two places to the left.
2. Estimate that $\$1,000 \times .05 = \50.00 ; therefore, the answer will be slightly more than \$50.00.
3. Multiply in your head: $\$1,000 \times .005 = \5.00
4. Adding $\$50 + \5 , the total interest on \$1,000 would be \$55.00.
5. **Answer: \$55.00**



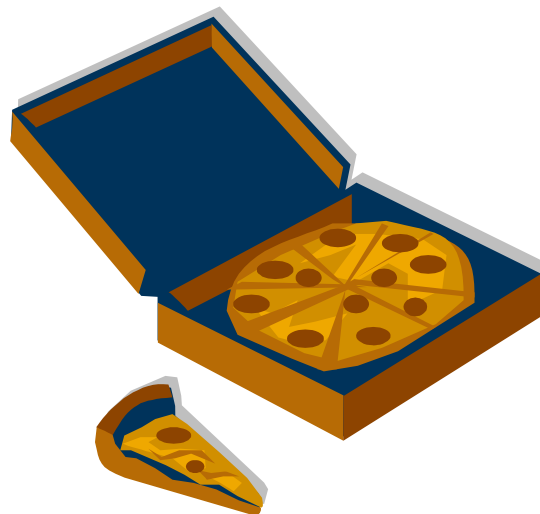
12. Physical Representations

Description:	Through <i>Physical Representations</i> , students use manipulatives to identify connections and recognize patterns. Manipulatives may include a wide variety of objects, including, but not limited to: blocks, coins, bills, marbles, chips, food slices, toothpicks, stones, shells, or noodles.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Interpret

Math Topic: Portion

Directions to Student: Use the model pizza slices (provided in class) to illustrate how many slices of pizza you would consume if you ate $\frac{1}{2}$ of a pizza.

Answer: The student will lay the pizza slices out on the table to illustrate how many pieces are in the entire pizza and then illustrate half of a pizza and describe how to calculate $\frac{1}{2}$ of the total number of pizza slices.



13. Pictorial Representations

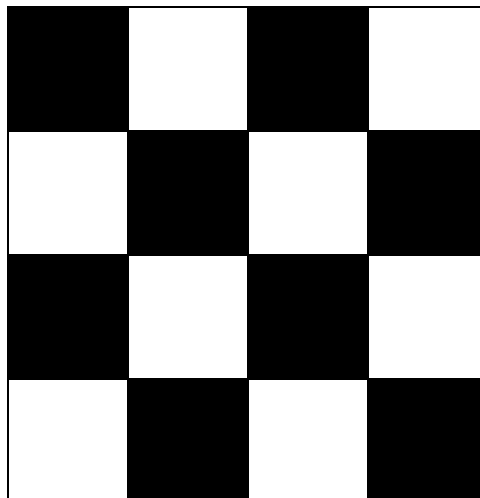
Description:	Through Pictorial Representations , students draw pictures of diagrams or construct lists, tables, or graphs in order to identify connections, recognize patterns, and build meaning. Pictorial Representations may be done by hand or by computer and range from very simple diagrams to complex, multi-dimensional drawings.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Interpret

Math Topic: Percentage

Problem: Mary wants to use 16 tiles to cover the top of an old table. She wants half of the tiles to be white, and the other half of the tiles to be black. Use the diagram below to illustrate how Mary might arrange the tiles for her table top.

Pictorial Representation:

(Students may create any pattern they like, as long as only 8 of the 16 tiles are colored.)



14. RAMMP

Description:	RAMMP is an acronym for Role-Audience-Medium-Math Problem R is the Role the writer is assuming (person or thing). A is the Audience for whom the text is written. M is the Medium of communication the writer is supposed to use. MP is the Math Problem you are supposed to discuss. A RAMMP helps students see the relevance of math operations in communicating with individuals in real-life situations.
Revised Bloom's Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Subcategory:	Implement

Math Topic: Computing Interest

Directions:

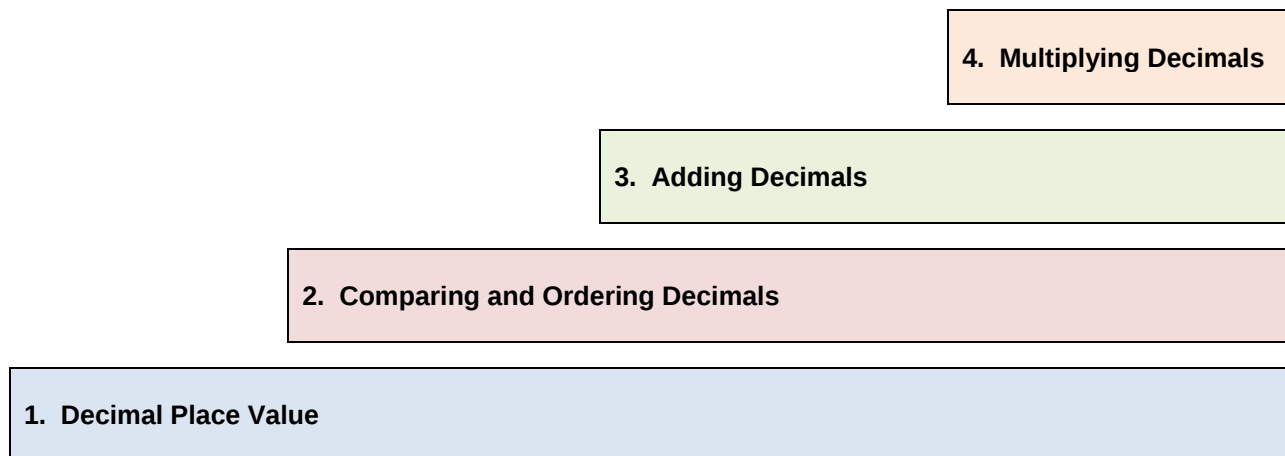
R	Role	You are going to assume the role of Mr. Summey's "personal banker".
A	Audience	You are to correspond with Mr. Summey regarding his account.
M	Medium	You will prepare a business letter.
MP	Math Problem	In the letter, state that Mr. Summey's current savings account balance is \$1,600 and that the annual interest rate on his account is 5%. State how interest earnings are calculated, and inform him of the amount of interest he can expect to receive this year.

Answer: The letter should be in business format and include the elements outlined in the "math problem" section, including the fact that the total interest earned will be \$80.00.

15. Scaffolding

Description:	Scaffolding means building understanding layer by layer. It involves teaching foundational skills so that the next highest level of understanding can be achieved. When scaffolding is successful, students are able to combine basic skills to accomplish more complex tasks.	
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)	Apply (C3)
RBT Category:	Classify	Implement

Math Topic: Working With Decimals



Problem:

John wants to start saving 15% of his income.

- What is the decimal place value of 15% **(.15)**
- Which would be greater, .015 or .150? **(.150)**
- John's income for this month was \$3,863.65. If John receives his income tax refund of \$165.98 this month and adds that to this month's salary, what will his total income be this month?
(3,863.65 + 165.98 = \$4,029.63)
- If John saves 15% of his total income this month, how much will he be able to add to his savings account? **(4,029.63 x .15 = \$604.44)**

16. Stop and GO

Description:	Stop and GO is a numeracy strategy that reminds students to stop and interpret information before trying to solve math problems. After students read a problem containing various items of numerical information, they “ Stop and Graphically Organize ” the information. There is no single correct way to organize; approaches vary from one student to another. Students should use any format that seems to work well with the types of information in the problem. The important thing to remember about “ Stop and GO ” is that many students will need to be encouraged to stop and do a graphic organizer when they do practice problems in class so they will remember to use this strategy on their own when taking tests.	
Revised Bloom’s Taxonomy Category & Cognitive Process:	Understand (B2)	Analyze (B4)
RBT Category:	Interpret	Organize

Problem: Net Gain/Net Loss

During the winter, Cole spent \$200 on entertainment, cashed in a savings bond worth \$300, paid rent of \$650, paid \$200 in school expenses, earned \$350 in wages and overtime, received \$600 from his scholarship, and paid utilities totaling \$150. Which is an accurate summary of Cole’s income, expenses, and net gain or loss?

	Income	Expenses	Net Gain or Loss
A.	\$1,250	\$1,200	Net Gain: \$50
B.	\$1,250	\$1,200	Net Loss: \$50
C.	\$950	\$1,500	Net Gain: \$550
D.	\$950	\$1,500	Net Loss: \$550

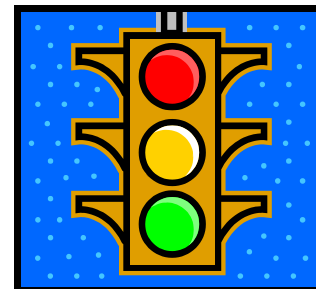
One Solution:

Category	Income	Expenses
Entertainment		200
Savings Bond	300	
Rent		650
School Expenses		200
Wages and Overtime	350	
Scholarship Money	600	
Utilities		150
Totals	1,250	1,200

Net Gain: \$50.00

Correct Answer: A

Stop & Graphically Organize!²



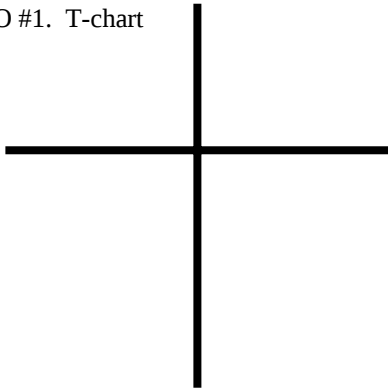
Teacher Directions: Use this page to help you prepare to teach students how to use the Stop and GO numeracy strategy when solving math word problems.

Here is the way Stop & Go works.

N Numeracy Strategy:

Stop & GO is a numeracy strategy that reminds students to “Stop and Graphically Organize” information before trying to solve math problems. After students read a problem containing various items of numerical information, they stop to interpret the information. There is no single correct way to organize; approaches vary from one student to another. Students should use any format that seems to work well with the types of information in the problem. The important thing to remember about “Stop and GO” is that many students will need to be encouraged to stop and do a graphic organizer when they do practice problems in class so they will remember to use this strategy when taking tests independently.

Show students basic ways information can be graphically organized. Draw some of the models below on a board or flip chart. Ask students what type of information would be most appropriate for each type of graphic organizer; or, ask what type of graphic organizer would be most appropriate for each type of information. Here are a few examples to get started.

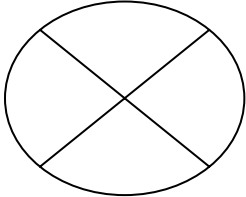
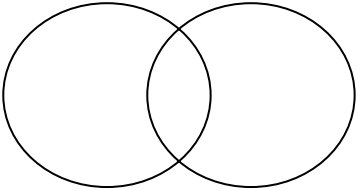
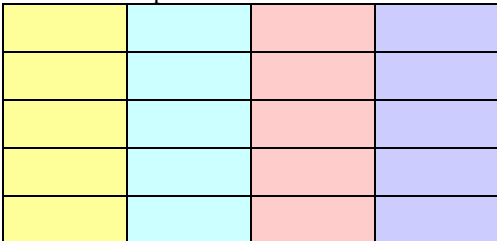
Type of Graphic Organizer	Recommended Uses
GO #1. T-chart 	• Sort into two categories ◦ Two types of something ◦ Pros and cons ◦ Advantages and disadvantages ◦ Facts and opinions ◦ Benefits and limitations ◦ Any pairs of opposites ◦ Before and after ◦ Then and now ◦ Like and dislike ◦ Tentative and final ◦ Fixed and flexible

² 7086 Personal Finance, Appendix 8.03B, Summer 2010

7086 Personal Finance

Appendix 8.03B

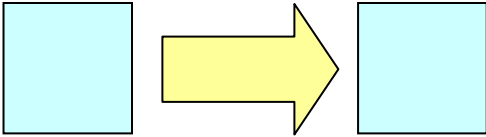
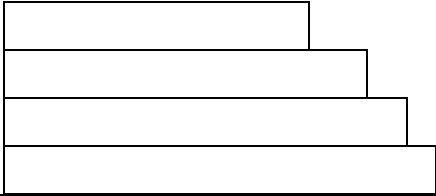
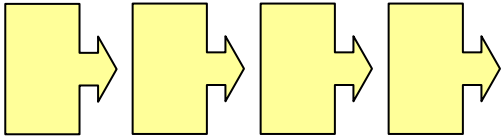
Teacher Reference: Stop & Graphically Organize! (continued)

Type of Graphic Organizer	Recommended Uses
GO #2. Pie chart 	- Show percentages or fractions---the proportion of parts relative to the whole - Categories of income within total income - Categories of expense within total expenses - Data about a specific concept - Shares of ownership - Categories of a spending plan - Options - Relative amounts of spending by category - Survey data
GO #3. Venn Diagram 	- Sort into distinct categories with in-between categories in the overlap section - Two distinct categories in right and left, with "hybrids" in the overlap section - Differences in right and left sections and similarities in the overlap - Opposite opinions in right and left, with "undecideds" in the overlap - Opposite concepts in right and left, with middle-road, gray-area concepts in overlap
GO #4. Multiple-column Chart 	- Show the same information about multiple categories (more than 2) - Categories may be listed across the top as column headers or down the left column as row labels - Types of information may be listed as column headers or row labels - Each cell is completed with the specific type of information for that particular category

7086 Personal Finance

Appendix 8.03B

Teacher Reference: Stop & Graphically Organize! (continued)

Type of Graphic Organizer	Recommended Uses
GO #5. Cause and Effect Model 	- Explain how one factor leads to another - Behavior leads to incident/event - Factor causes occurrence - Cause produces effect - Stressor influences outcome - Habit leads to outcome
GO #6. Steps and Hierarchies 	- Shows steps and relative importance - Steps in a process---such as the process of decision making, financial planning, filing a complaint, etc. - Stages of development - Levels of achievement - Rankings to show relative importance
GO #7. Sequences 	- Actions in a sequence - Flow of information - Chain of happenings - Recommended or required order - What happens first, second, and so on . . . - Events in chronological order, as a timeline

After teaching students some basic graphic organizers, present a math problem related to an objective of study. Discuss whether a graphic organizer would be helpful for this type of problem and the amount of information contained in the problem. If so, have students suggest a type of organizer that might match the problem. Remind them that basic types shown here should be considered, but some problems may require something different. Have students graphically organize the information in the problem. Share results; emphasize that there may be more than one “right” way to “GO” a problem.

17. Think-Solve-Pair-Share

Description:	The Think-Solve-Pair-Share strategy allows students to work in groups of two. Each student works the problem, and then they take turns sharing their work with each other.
Revised Bloom's Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Subcategory:	Implement

Math Topic: Decimals and Fractions

Problem: Vicki earned \$29.75 for working 3 ½ hours. What was her hourly wage?

Think	About what you need to do to solve this problem.
Solve	Work the problem below by yourself.
Pair	Then work with your partner.
Share	Compare answers and share with each other how you arrived at your answer.

Solution: $29.75 \div 3.5 = \$8.50$



18. 3 x 3 Math Chart

Description:	After learning new math terminology, students use the words in the 3 x 3 Math Chart to write sentences using the words in each row and in each column. (6 sentences using words in Rows 1, 2, 3 and Columns 1, 2, 3) This strategy requires students to describe similarities and differences among math terms and related concepts.
Revised Bloom's Taxonomy Category & Cognitive Process:	Understand (B2)
RBT Subcategory:	Compare

Math Topic: Math Vocabulary

Directions: Write sentences using the words in each column. (6 total sentences using words in Rows 1, 2, 3 and Columns 1, 2, 3)

Parabola	Equation	Slope
Coefficient	Exponent	Linear
Line	Constant	Quadratic

Example: (Row 1)

1. A parabola is the U-shaped graph of a quadratic equation that doesn't have a slope because the lines are not straight

19. Track Your Thinking

Description:	The <i>Track Your Thinking</i> strategy provides students with a way of keeping track of the steps they take as they reason through a math problem to reach a solution. Encourage students to write down each mental calculation they do, step by step, no matter how simple or automatic the step may be.
Revised Bloom's Taxonomy Category & Cognitive Process:	Apply (C3)
RBT Subcategory:	Implement

Math Topic: Credit Card Debt

Problem: Joseph had a credit card balance of \$278.24 at the beginning of the month. He bought some clothes for \$135.30, and a TV for \$221.28. At the end of the month, he made a payment of \$350. How much money is needed to pay off his debt completely?

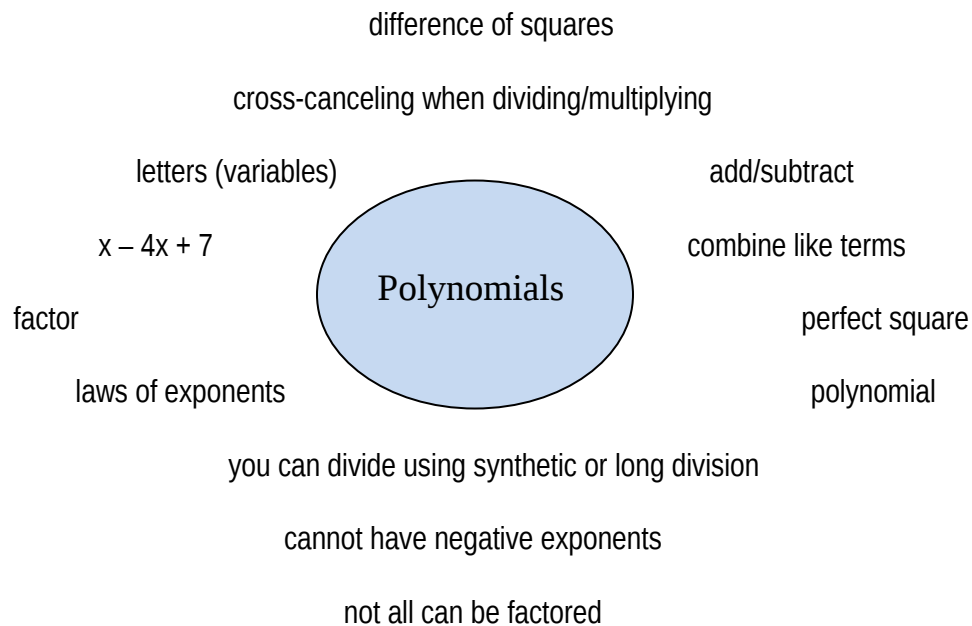
Directions: Track Your Thinking

	Step 3: If he made a payment of \$350, his new balance would be 634.82 – 350 or \$284.82
	Step 2: His new purchases included: $135.30 + 221.28$ or 356.58 $356.38 + 278.24 = 634.82$ (his new balance)
	Step 1: Joseph's starting balance on his credit card was \$278.24

20. Word Splash 4 Math

Description:	Word Splash 4 Math requires the students to write a key term or concept inside a circle. Around the circle they describe the key term or concept by listing characteristics, attributes, related words/ideas, and examples to show what they've learned.
Revised Bloom's Taxonomy Category & Cognitive Process:	Remember (A1)
RBT Subcategory:	Recall

Math Topic: Polynomials



Part 9: Revised Bloom's Taxonomy

Table 2: The Cognitive Process Dimension

CATEGORIES & COGNITIVE PROCESSES	ALTERNATIVE NAMES	DEFINITIONS AND EXAMPLES
1. REMEMBER—Retrieve relevant knowledge from long-term memory		
1.1 RECOGNIZING	Identifying	Locating knowledge in long-term memory that is consistent with presented material (e.g., Recognize the dates of important events in United States history)
1.2 RECALLING	Retrieving	Retrieving relevant knowledge from long-term memory (e.g., Recall the dates of important events in United States history)
2. UNDERSTAND—Construct meaning from instructional messages, including oral, written, and graphic communication		
2.1 INTERPRETING	Clarifying, paraphrasing, representing, translating	Changing from one form of representation (e.g., numerical) to another (e.g., verbal) (e.g., Paraphrase important speeches and documents)
2.2 EXEMPLIFYING	Illustrating, instantiating	Finding a specific example or illustration of a concept or principle (e.g., Give examples of various artistic painting styles)
2.3 CLASSIFYING	Categorizing, subsuming	Determining that something belongs to a category (e.g., Classify observed or described cases of mental disorders)
2.4 SUMMARIZING	Abstracting, generalizing	Abstracting a general theme or major point(s) (e.g., Write a short summary of events portrayed on a videotape)
2.5 INFERRING	Concluding, extrapolating, interpolating, predicting	Drawing a logical conclusion from presented information (e.g., In learning a foreign language, infer grammatical principles from examples)
2.6 COMPARING	Contrasting, mapping, matching	Detecting correspondences between two ideas, objects, and the like (e.g., Compare historical events to contemporary situations)
2.7 EXPLAINING	Constructing models	Constructing a cause-and-effect model of a system (e.g., Explain the causes of important 18th Century events in France)
3. APPLY—Carry out or use a procedure in a given situation		
3.1 EXECUTING	Carrying out	Applying a procedure to a familiar task (e.g., Divide one whole number by another whole number, both with multiple digits)
3.2 IMPLEMENTING	Using	Applying a procedure to an unfamiliar task (e.g., Use Newton's Second Law in situations in which it is appropriate)

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Source of Information: A TAXONOMY FOR LEARNING, TEACHING, AND ASSESSING, A Revision of Bloom's Taxonomy of Educational Objectives by Lorin W. Anderson and David R. Krathwohl

Revised Bloom's Taxonomy

Table 2: The Cognitive Process Dimension

CATEGORIES & COGNITIVE PROCESSES	ALTERNATIVE NAMES	DEFINITIONS AND EXAMPLES
4. ANALYZE—Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose		
4.1 DIFFERENTIATING	Discriminating, distinguishing, focusing, selecting	Distinguishing relevant from irrelevant parts or important from unimportant parts of presented material (e.g., Distinguish between relevant and irrelevant numbers in a mathematical word problem)
4.2 ORGANIZING	Finding coherence, integrating, outlining, parsing, structuring	Determining how elements fit or function within a structure (e.g., Structure evidence in a historical description into evidence for and against a particular historical explanation)
4.3 ATTRIBUTING	Deconstructing	Determine a point of view, bias, values, or intent underlying presented material (e.g., Determine the point of view of the author of an essay in terms of his or her political perspective)
5. EVALUATE—Make judgments based on criteria and standards		
5.1 CHECKING	Coordinating, detecting, monitoring, testing	Detecting inconsistencies or fallacies within a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented (e.g., Determine if a scientist's conclusions follow from observed data)
5.2 CRITIQUING	Judging	Detecting inconsistencies between a product and external criteria, determining whether a product has external consistency; detecting the appropriateness of a procedure for a given problem (e.g., Judge which of two methods is the best way to solve a given problem)
6. CREATE—Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure		
6.1 GENERATING	Hypothesizing	Coming up with alternative hypotheses based on criteria (e.g., Generate hypotheses to account for an observed phenomenon)
6.2 PLANNING	Designing	Devising a procedure for accomplishing some task (e.g., Plan a research paper on a given historical topic)
6.3 PRODUCING	Constructing	Inventing a product (e.g., Build habitats for a specific purpose)

Source of Information: A TAXONOMY FOR LEARNING, TEACHING, AND ASSESSING, A Revision of Bloom's Taxonomy of Educational Objectives by Lorin W. Anderson and David R. Krathwohl

Part 9: Best Practices



Where are some “Best Practices” in my region?



Math-in-CTE Technical Assistance Newsletter

Catawba County, North Carolina 2009

This summer, 33 Catawba County teachers—Family and Consumer Sciences and Business/Marketing teachers and their math partners—spent five days of their summer break immersed in learning a way of teaching designed to improve their students' performance in math. Working together, the teacher teams developed curriculum maps, wrote math-enriched CTE lessons, and presented these lessons to their peers in preparation for implementing them in their classrooms. Most importantly, they developed a cooperative community of practice.

Karen Cale, Catawba County CTE director, said, "It was exciting to see the exchange that occurred as CTE teachers planned lessons with the input of the math teachers! Math teachers developed a greater appreciation of the CTE course content and CTE teachers were able to gain new strategies to teach the applied math concepts."

When teachers were asked what three things they had learned this week, one math partner answered, "I have learned the different topics that CTE teachers down the hall are teaching that directly impact my curriculum. I have gained some fun ways to connect my math topics to CTE. [And] I have learned that CTE textbooks don't always do a great job with the math." A CTE teacher replied, "[I learned] how important it is to use the same vocabulary concerning math that the students have been taught in their math classes..., the importance of developing a relationship with the math teachers, and to not be afraid to ask for their help. [And that] students will benefit greatly from a partnership of Math and CTE [teachers]."

These North Carolina teachers will spend the first few months of the school year teaching the math-enhanced lessons to students, and they will meet again in November to share their successes and challenges.

Science-in-CTE Pilot study begins in North Dakota
(See page 4)



Above, left to right: David Hopkins, Natalie Beddingfield, Don Hensley (standing), Pam Medlin, Marvin Miller.

Below: Audrey Hovis (left) and Caron Simpson plan a foods lesson that incorporates thermometer reading.



"Too long our students have learned subject matter in isolation. By utilizing the Math-in-CTE model concepts, CTE teachers are able to . . . expose students to the occupational relevance of the math curriculum. Our school system has incorporated the Math-in-CTE Model into our Strategic Plan and anticipates expanding this to more program areas in the years to come."

Karen Cale, Director
Career and Technical Education,
Catawba County Schools.

What can I do in my LEA?



Part 10: Resources

ARTICLES:

1. Academics in CTE Programs: Fully Preparing Students for Their Next Step, *TECHNIQUES*, November/December 2008
2. ACE Tech: The Fourth Year of CTE and Academic Integration, *TECHNIQUES*, November/December 2008
3. Aligning Classroom Instruction with Workplace Skills, *TECHNIQUES*, November/December 2008
4. A National Effort to Integrate Math and Science with CTE, *TECHNIQUES*, November/December,
5. Building a Better Technician: One Teacher's Account, *TECHNIQUES*, March 2009
6. Early Identification and Interventions for Students with Mathematics Difficulties, *JOURNAL OF LEARNING DISABILITIES*, Volume 38, Number 4, July/August 2005
7. *EDUCATIONAL LEADERSHIP*, November 2007, Volume 65, Number 32
8. Female Teachers May Pass math Anxiety to Girls, *CHICAGO TRIBUNE*, February 17, 2010
9. Girls may Lean Math Anxiety From Teachers, *ROCKY MOUNT TELEGRAM*, January 26, 2010
10. How and Where Academic Content is Taught, *TECHNIQUES*, January 2007
11. Integrating CTE and Academics: One Teacher's Account, *TECHNIQUES*, November/December 2008
12. Integrating CTE and Academics: One Student's Account, *TECHNIQUES*, November/December 2008
13. Magical Hopes: Manipulatives and the Reform of Math Education, *AMERICAN EDUCATOR*, Summer 1992
14. Promoting More Powerful Learning, *TECHNIQUES*, November/December, 2008
15. Reform by the Book: What Is—or Might Be—the Role of Curriculum Materials in Teacher Learning and Instructional Reform?, *EDUCATIONAL RESEARCHER*, December 1996
16. Teaching Number Sense, *EDUCATIONAL LEADERSHIP*, February 2004
17. The Value of Math-in-CTE, *TECHNIQUES*, September 2009
18. Tips for Teaching Math to CTE Students, *TECHNIQUES*, March 2009
19. Understanding "Math Anxiety", *EDUCATION WEEK*, February 21, 2007, Sean Cavanagh
20. Why is Numeracy Important? National Research Council, 2001

BOOKS:

1. ALL THE MATH YOU'LL EVER NEED, Steve Slavin ISBN 0-471-31751-9
2. APPLIED CONSTRUCTION MATH: A Novel Approach, National Center for Construction Education and Research ISBN 0-13-227298-9
3. ARITHMETIC MADE SIMPLE, Robert Belge, ISBN 0-385-23938-6
4. BARRON'S E-Z MATH, Anthony Prindle and Katie Prindle ISBN-13: 978-0-7641-4132-4

5. MATHEMATICS DICTIONARY AND HANDBOOK, Nichols, Schwartz Publishing ISBN 1-882269-07-1
6. MATHEMATICS, DRAWINGS, AND SPECIFICATIONS, Module 28104, Wheels of Learning, National Center for Construction Education and Research
7. MATH MADE EASY, John Kennedy, ISBN 978-0-7894-5735-6
8. PRACTICAL MATH: SUCCESS IN 20 MINUTES A DAY, Learning Express ISBN: 978-1-57685-682-6
9. TEACHING MATHEMATICS WITH FOLDABLES, Dinah Zike, ISBN 0-07-830413-X

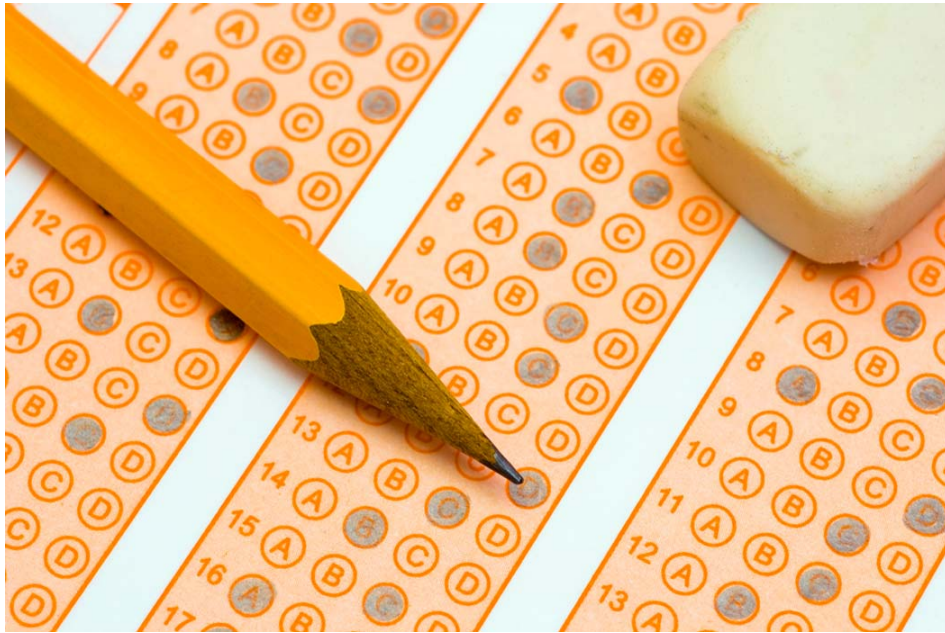
REPORTS:

1. Adding It Up, National Research Council
2. Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE, National Research Center for Career and Technical Education
3. Foundations for Success, The National Mathematics Advisory Panel Final Report, 2008
4. Joining Forces for Student Success, ACTE, February 2009
5. Numeracy, St. Olaf College, Lynn Arthur Steen
6. Retooling Career Technical Education, NGA Center for Best Practices
7. Rigor and Relevance: A Model of Enhanced math Learning in Career and Technical Education, National Research Center for Career and Technical Education, University of Minnesota
8. Sustaining the Impact: A Follow-up of the Teachers Who Participated in the Math-in-CTE Study, national Research Center for Career and Technical Education
9. Teaching for Understanding through Integration of Academic and Technical Education, Gene Bottoms and Deede Sharpe
10. What Can All Teachers Do Now to Enhance Numeracy? Adapted from SREB, 2003
11. What is the Math-in-CTE Model? National Research Center for Career and Technical Education
12. Why is Numeracy Important? National Research Council, 2001

OTHER:

1. CTE-Academic Integration: 30+ Publications on Integrating Academics into the CTE Classroom from Leaders in the Field--CD, ACTE

Part 11: Answer Keys



Pretest: Answer Key

Math Strategy #	Problem	Answers
1. (#4)	Shade $\frac{1}{3}$ of this rectangle. 	
	27% of 8th graders cannot correctly shade $\frac{1}{3}$ of a rectangle	
2. (#17)	Vicki earned \$29.75 for working $3\frac{1}{2}$ hours. What was her hourly wage? 	$29.75 \div 3.5 = \mathbf{\$8.50}$
	45% of 8th graders cannot solve a word problem that required dividing fractions.	
3. (#5)	Greg wants to leave a 15% tip on a \$35 meal. How much should he leave? 	$35 \times .15 = \mathbf{\$5.25}$
	58% of adults cannot calculate a 15% tip for a lunch bill.	
4. (#9)	When Eric left home, the odometer on his car read 32,416 miles. When he arrived at his destination it read 33,027. How many miles had he traveled? If he used 47 gallons of gas, how many miles per gallon did he get? 	$33,027 - 32,416 = \mathbf{611 \text{ mi}}$ $611 \div 47 = \mathbf{13 \text{ mpg}}$
	71% of adults cannot calculate miles per gallon on a trip.	
5. (#11)	How much interest would Wendy be charged on a loan of \$1,000 with an interest rate of 5.5% 	$\$1,000 \times .055 = \mathbf{\$55}$
	78% of adults cannot explain how to compute the interest paid on a loan.	

Using Whole Numbers in CTE: Answer Key

Agriculture	All together, the FFA students at Central High School own 40 cows, 12 horses, 25 sheep, and 18 goats. How many animals do the FFA students own?	$ \begin{array}{r} 40 \\ 12 \\ 25 \\ \underline{18} \\ 95 \end{array} $
Business (#9)	I want to qualify to run Cross Country next semester, but my parents and the coach have told me that I must have at least an average of <u>85 or better</u> in all of my courses this semester in order to join the team. So far my grades in Computer Applications are: 75, 85, 83, 71, and 91. What is my current average in Computer Applications? $75 + 85 + 83 + 71 + 91 = 405$ $405 \div 5 = \mathbf{81}$	81
Career Development	An apprenticeship student at Northern High School earned \$470.00 in August, and \$875 in September. How much more did he make in September than he did in August?	$ \begin{array}{r} 875 \\ - 470 \\ \hline \$ 405 \end{array} $
FACS	The FCCLA Chapter at Southern High School had 267 members in 2005, 314 in 2006, 201 in 2007, 298 in 2008, and 320 in 2009. How many members have they had in the last five years?	$ \begin{array}{r} 267 \\ 314 \\ 201 \\ 298 \\ \underline{320} \\ 1,400 \end{array} $
HOE	The HOSA Club at Northwest High School raised money for the Children's Hospital. 127 students donated \$2 each, and 261 students donated \$3 each. How much did the HOSA Club raise altogether for the hospital? $(127 \times 2 = 254)$ $(261 \times 3 = 783)$ $(254 + 783 = \mathbf{1037})$	$ \begin{array}{r} 254 \\ + 783 \\ \hline \$ 1,037 \end{array} $
Marketing (#3)	A new flat screen TV costs \$450 in cash. On the installment plan a down payment of \$100 plus 18 monthly payments of \$22.50 is needed. How much is saved by paying cash? $(18 \times 22.50 = 405)$ $(405 + 100 = 505)$ $(505 - 450 = \mathbf{55})$	\$55.00
Tech Ed	There are 30 students in the Principles of Technology class. If the teacher wants to divide the class into six groups to work on special projects, how many students will be in each group?	$30 \div 6 = \mathbf{5}$
T & I	An electrician uses 480 yards of electrical wire in six apartments. If he uses the same amount in each, how much does he use per house?	$480 \div 6 = \mathbf{80}$

More Practice with Whole Numbers: Key

1.	Dillard's is having a sale on Estee Lauder perfume at \$90 a bottle. How much would you have to pay for 12 bottles? ($90 \times 12 = 1,080$)	\$1,080
2.	A car dealer sold 75 used cars at \$10,995 each. What were his total sales? ($10,995 \times 75 = 824,625$)	\$824,625
3.	Best Buy sold 234 Blu-Ray Disc Players at \$235 each. How much is the store's total sales of this product? ($235 \times 234 = 54,990$)	\$54,990
4.	If light travels at the rate of 186,000 miles per second, how far does it travel in two minutes? ($186,000 \times 120 \text{ seconds} = 22,232,000$)	22,232,000
5.	If a train travels at an average speed of 70 miles per hour, how far has the train traveled in 14 hours? ($70 \times 14 = 980$)	980 miles
6.	There are 5,280 feet in a mile. If you walked 18 miles, how many feet did you walk? ($5280 \times 18 = 95,040$)	95,040
7.	In a school yard there are 264 children. How many soccer teams of 11 players each can be formed? ($264 \div 11 = 24$)	24
8.	Vicki earned \$104,000 last year. How much did she earn per week? ($104,000 \div 52 = 2,000$)	\$2,000
9.	If a rope is 144 inches long, how many yards long is that rope? ($144 \div 36 = 4$)	4 yards
10.	Dell Corporation had a payroll of \$7,500,000 for 864 workers who all earned exactly the same annual pay. How much did each worker earn? ($7,500,000 \div 864 = 8,680.56$)	\$8,680.56
11.	Sampson, the neighbor's dog, chews up 12,775 bones a year. How many bones does he go through in a day? ($12,775 \div 365 = 35$)	35
12.	Eric is setting up his new office. He purchased the following equipment: desk (\$499), chair (\$89), computer (\$1,289), and file cabinets (\$76). How much did he spend to furnish his office? ($499 + 89 + 1,289 + 76 = 1,953$)	\$1,953
13.	Sixteen employees in an office went in together to purchase NC Education Lottery tickets and won \$6,000,000. How much will each person receive if they divide their winnings up equally? ($6,000,000 \div 16 = 375,000$)	\$375,000
14.	Ted has \$4,762 in stocks and \$2,247 in his bank. How much does he have all together? ($4762 + 2247 = 7,009$)	\$7,009
15.	A store in Charlotte takes in \$98,651 on a Saturday. A small branch in Rocky Mount takes in \$33,247. How much more does the Charlotte store take in? ($98,651 - 33,247 = 65,404$)	\$65,404
16.	John is completing his Marketing Co-op experience. He has earned \$8.00 an hour. This month he worked 65 hours. How much did he earn this month? ($65 \times 8 = 520$)	\$520
17.	Add: $468 + 645$	1,113
18.	Subtract: $7,527 - 149$	7,378
19.	Multiply: 989×67	66,263
20.	Divide: $840 \div 5$	168

Using Fractions in CTE: Answer Key

Agriculture	Marty bought two pigs. Their combined weight was $315 \frac{1}{2}$ pounds. If one pig weighed $132 \frac{3}{4}$ pounds, how much did the second one weigh? $(314 \frac{6}{4} - 132 \frac{3}{4} = 182 \frac{3}{4})$	182 $\frac{3}{4}$
Business (#6)	A virus infected Wendy's computer and she lost $\frac{5}{7}$ of the songs she had on her computer. If she is left with 172 songs, how many songs did she have before her computer was infected with the virus? $(\frac{2}{7} = 172 \text{ so } \frac{1}{7} = 86) \quad (86 \times 7 = 602)$	602
Career Development	Brad works for \$6.80 an hour, plus time and a half for all hours over 40. One week he worked 48 hours. What did he earn? $(6.80 \times 40 = 272) \quad (6.80 \times 1 \frac{1}{2} = 10.20) \quad (10.20 \times 8 = 81.60) \quad (272 + 81.60 = 353.60)$	\$353.60
FACS	Double each of the following ingredients: $\frac{1}{2}$ c. flour $\frac{3}{4}$ c. milk $\frac{1}{8}$ tsp. vanilla	1 c. flour 1 $\frac{1}{2}$ c. milk $\frac{1}{4}$ tsp. vanilla
HOE	At the weight loss center last week, Max lost $3 \frac{1}{2}$ pounds, Karen lost $2 \frac{7}{8}$ pounds, and Sharon lost $1 \frac{3}{4}$ pounds. How much weight did the three of them lose all together? $(\frac{7}{2} + \frac{23}{8} + \frac{7}{4} =) \quad (\frac{28}{8} + \frac{23}{8} + \frac{14}{8} = \frac{65}{8}) \quad (65 \div 8 = 8 \frac{1}{8})$	8 $\frac{1}{8}$ lbs.
Marketing (#12)	If a pizza was cut into 6 equal slices, and you ate 3 of them, what portion of the pizza did you eat? $\frac{3}{6} = \frac{1}{2}$	$\frac{1}{2}$
Tech Ed	The scale on a blueprint reads $\frac{1}{2}$ " to 1'. If the living room is to be 21' long, how long will it be on the blueprint? $(21 \times \frac{1}{2} = \frac{21}{2} \text{ or } 10 \frac{1}{2})$	10 $\frac{1}{2}$"
T & I	How many strips of wood $\frac{5}{8}$ of an inch wide can be sawed off a 5-foot piece of wood? $(60 \div \frac{5}{8}) \quad (\frac{60}{1} \times \frac{8}{5} = \frac{480}{5}) \quad (\frac{480}{5} = 96)$	96

More Practice with Fractions: Answer Key

1.	How much would it cost to buy $4\frac{2}{3}$ yards of cloth at \$11 per yard? $(4\frac{2}{3} \times 11 = \frac{14}{3} \times \frac{11}{1} = \frac{154}{3} = \mathbf{51.33})$	\$51.33
2.	Amy and Cheryl went on diets. Together they lost $20\frac{3}{4}$ pounds. If Cheryl lost $12\frac{1}{8}$ pounds, how much did Amy lose? $(20\frac{3}{4} - 12\frac{1}{8}) \quad (20\frac{6}{8} - 12\frac{1}{8} = \mathbf{8\frac{5}{8}})$	$8\frac{5}{8}$ lbs.
3.	If you walked 23 miles at an average speed of $13\frac{1}{4}$ minutes per mile, how long did it take you to walk the entire distance? $(23 \times \frac{53}{4} = \frac{1219}{4} = 304\frac{3}{4} \text{ min.}) \quad (304\frac{3}{4} = \mathbf{5 \text{ hr. } 4 \text{ min. } 45 \text{ sec.}})$	5 hr. 4 min. 45 sec.
4.	How many $\frac{1}{2}$ pint containers can be filled from a 5-gallon can? (2 pints = 1 quart) (4 quarts = 1 gallon) (8 pints = 1 gallon) (40 pints = 5 gallons) $(2 \times 40 = \mathbf{80})$	80
5.	Farmer Jones bought $7\frac{1}{2}$ bales of hay for \$30. How much did 1 bale cost? $(30 \div 7\frac{1}{2}) = (\frac{30}{1} \div \frac{15}{2}) = (\frac{30}{1} \times \frac{2}{15} = \frac{60}{15} = \mathbf{4})$	\$4.00
6.	Janis needs $4\frac{3}{5}$ feet of ribbon to tie a bow around a box. If she only has $3\frac{1}{2}$ feet of ribbon, how much ribbon is she short? $(4\frac{3}{5} - 3\frac{1}{2}) = (2\frac{3}{5} - 7/2) = (46/10 - 35/10 = 11/10 \text{ or } \mathbf{1\frac{1}{10}})$	$1\frac{1}{10}$
7.	John worked 14 days out of a 31-day month. What fraction of the month did he work? (14 out of 31 = $\mathbf{14/31}$)	$14/31$
8.	A certain recipe calls for 3 ounces of cheese. What fraction of a 15-ounce piece of cheese is needed? ($3/15$ or $\mathbf{1/5}$)	$1/5$
9.	Mark had \$10 in his wallet. He spent \$6 for his lunch and left a \$1 tip. What fraction of his money did he spend on his lunch, including the tip? ($\mathbf{7/10}$)	$7/10$
10.	If Linda makes \$2,000 a month and pays \$750 for rent, what fraction of her income is spent on rent? ($750/2000 = \mathbf{3/8}$)	$3/8$
11.	During a 30-day month, there were 8 weekend days and 1 paid holiday during which Marlene's office was closed. Marlene took off 3 days when she was sick and 2 days for personal business. If she worked the rest of the days, what fraction of the month did Marlene work? $(8 + 1 + 3 + 2 = 14) \quad (30 - 14 = 16) \quad (16/30 = \mathbf{8/15})$	$8/15$
12.	An outside wall consists of $\frac{1}{2}$ inch of drywall, $3\frac{3}{4}$ inches of insulations, $\frac{5}{8}$ inch of wall sheathing, and 1 inch of siding. How thick is the entire wall, in inches? $(\frac{1}{2} + 3\frac{3}{4} + \frac{5}{8} + 1) = (4/8 + 3\frac{6}{8} + 5/8 + 1 = 4\frac{15}{8} \text{ or } \mathbf{5\frac{7}{8}})$	$5\frac{7}{8}$
13.	A window is 50 inches tall. To make curtains, Anya will need two more feet of fabric than the height of the window. How many yards of fabric will she need? $(50 + 24 = 74 \text{ in.}) \quad (74 \div 36 = 2\frac{2}{36} \text{ or } \mathbf{2\frac{1}{18}})$	$2\frac{1}{18}$
14.	Richard needs 12 pounds of fertilizer but has only $7\frac{5}{8}$ pounds. How many more pounds of fertilizer does he need? $(12 - 7\frac{5}{8}) = (11\frac{8}{8} - 7\frac{5}{8} = \mathbf{4\frac{3}{8}})$	$4\frac{3}{8}$
15.	A computer can burn a CD $2\frac{1}{2}$ times faster than it would take to play the music. How long will it take to burn 85 minutes of music? $(85 \div 2.5 = \mathbf{34})$	34 min.
16.	How many $2\frac{1}{2}$ pound chunks of cheese can be cut from a single 20-pound piece of cheese? $(20 \div 2.5 = \mathbf{8})$	8
17.	Add: $2\frac{3}{4} + 3\frac{1}{6} + 4\frac{1}{12} \quad (2\frac{9}{12} + 3\frac{2}{12} + 4\frac{1}{12} = 9\frac{12}{12} \text{ or } \mathbf{10})$	10
18.	Subtract: $2\frac{2}{3} - 2/4 \quad (2\frac{8}{12} - 3/12 = \mathbf{2\frac{5}{12}})$	$2\frac{5}{12}$
19.	Multiply: $2/5 \times 3/4 \quad (6/20 \text{ or } \mathbf{3/10})$	$3/10$
20.	Divide: $\frac{1}{2} \div \frac{1}{4} \quad (1/2 \times 4/1 = 4/2 \text{ or } \mathbf{2})$	2

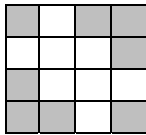
Using Decimals in CTE: Answer Key

Agriculture	Farmer Brown bought 7.5 bales of hay for \$30. How much did 1 bale cost? (30 ÷ 7.5 = 4) Note: Compare to More Practice in Fractions, # 9.	\$4.00
Business (#19)	Joseph had a credit card balance of \$278.24 at the beginning of the month. He bought some clothes for \$135.30 and a TV for \$221.28. At the end of the month, he made a payment of \$350. How much money is needed to pay off his debt completely? (278.24 + 135.30 + 221.28 = 634.82) (634.82 – 350.00 = 284.82)	284.82
Career Development (# 15)	John's income for this month was \$3,863.65. If John receives his income tax refund of \$165.98 this month and adds that to this month's salary, what will his total income be this month? 3,863.65 + 165.98 = \$4,029.63 If John saves 15% of his total income this month, how much will he be able to add to his savings account? 4,029.63 x .15 = \$604.44	\$4,029.63 \$604.44
FACS	At the supermarket, Mary Jo purchased 2.3 pounds of tomatoes, 1.1 pounds of lettuce, a 0.6 pound cucumber, and 4 pounds of carrots. She also decided to buy 1.2 pounds of bananas. How many pounds of produce did Mary Jo buy? (2.3 + 1.1 + .6 + 4.0 + 1.2 = 9.2)	9.2
HOE	A cardboard box can hold a total of 26 pounds. If a bottle of hand sanitizer weighs 0.4 pounds, how many bottles can the box hold? (26 ÷ .4 = 65)	65
Marketing	If Mr. Siegel bought items costing \$3.75, \$2.89, and \$7.05, how much change should he receive from a \$20 bill? (3.75 + 2.89 + 7.05 = 13.69) (20.00 – 13.69 = 6.31)	\$6.31
Tech Ed	If silver wire were sold for 40 cents an inch, how much would it cost to buy 2 yards of wire? (Hint: Convert 2 yards to 72 inches) (72 x .40 = 28.80)	\$28.80
T & I	One inch is about the same as 2.54 centimeters. Approximately how many centimeters are in a foot? (2.54 x 12 = 30.48)	30.48 cm.

More Practice with Decimals: Answer Key

1.	If gold were selling at \$450 an ounce, how much gold could you buy for \$7,875? ($7875 \div 450 = 17.5$)	17.5 oz.
2.	How much change from a \$20 bill would you receive if you bought items costing \$1.75, \$3.39, and \$6.21? ($1.75 + 3.39 + 6.21 = 11.31$) ($20 - 11.35 = 8.65$)	\$8.65
3.	How much change from a \$50 bill would you receive if you bought items costing \$13.95, \$6.08, and \$24.35? ($13.95 + 6.08 + 24.35 = 44.38$) ($50.00 - 44.38 = 5.62$)	\$5.62
4.	At \$2.57 per gallon of gas, what is the cost of 15 gallons? ($2.57 \times 15 = 38.55$)	\$38.55
5.	Angelica, Ashley, and Aimee go to play miniature golf together. The total bill for their groups comes to \$23.25. If Aimee has a \$10 bill to pay with, how much change should she get back from the other girls once the bill has been paid? ($23.25 \div 3 = 7.75$) ($10.00 - 7.75 = 2.25$)	\$2.25
6.	Melba spent \$117.48 at the grocery store on August 7, \$74.60 on August 15, and \$88.36 on August 24. What is the average amount of money she spent on groceries in these three trips? ($117.48 + 74.60 + 88.36 = 280.44$) ($280.44 \div 3 = 93.48$)	\$93.48
7.	Janice improved her time running a mile in track from 6.3 to 5.66 minutes. By how much time did she improve? ($6.30 - 5.66 = .64$)	.64
8.	John loaned Alexis \$70.28 on Friday, and on Saturday, Alexis thanked him by paying him back \$75. How much extra money did Alexis give to John? ($75.00 - 70.28 = 4.72$)	4.72
9.	Karin bought three books for \$8.95 each and two magazines for \$1.49 each. How much did she spend in total? ($3 \times 8.95 = 26.85$) ($1.49 \times 2 = 2.98$) ($26.85 + 2.98 = 29.83$)	29.83
10.	Jeff runs an average mile in 7.3 minutes when he exercises after work. How many miles has he run after 42 minutes, rounded to the nearest tenth? ($42 \div 7.3 = 5.75 = 5.8$)	5.8
11.	Working at an assembly plant, Audrey made 326 items in five days. How many items did she average per day? ($326 \div 5 = 65.2$)	65.2
12.	With the cost of flour at \$4.25 pound, how much do 3.4 pounds cost, rounded to the nearest cent? ($4.35 \times 3.4 = 14.45$)	\$14.45
13.	If gasoline costs \$3.92 per gallon, and filling up a car's tank costs \$49.00, how many gallons does the tank hold? ($49 \div 3.92 = 12.50$)	\$12.50
14.	At \$7.00 per pound, how many pounds of coffee can you get for \$3.15? ($3.15 \div 7 = .45$)	.45
15.	Jodi earned \$22.75 for working 3.5 hours. What was her hourly wage? ($22.75 \div 3.5 = 6.50$)	\$6.50
16.	Ronnie deposited three checks in his checking account for the following amounts: \$1,064, \$875, and \$67. He wants \$400 in cash, and will deposit the rest of the money. How much was his deposit? ($1,064 + 875 + 67 = 2,006$) ($2,006 - 400 = 1,606$)	\$1,606
17.	Add: $2.32 + 71.4 + 0.003$	73.723
18.	Subtract: $42.63 - 26.58$	16.05
19.	Multiply: 6.2×32.7	202.74
20.	Divide: $92.5 \div 3.7$	25

Using Percentages in CTE: Answer Key

Agriculture	Abe's Apple Farm has a yearly earnings goal of \$86,000. By July, the farm has earned \$27,520. What percentage of their yearly earnings goal has been earned by July? $(27,520 \div 86,000 = .32)$	32%
Business (#14)	On a bank account of \$1,600, how much yearly interest will be paid if the rate is 5%? $(1,600 \times .05 = \mathbf{80})$	\$80
Career Development	Latoya earns \$24,000 a year. Every month her rent payment is \$680. What percentage of her yearly income does she spend on rent? $(680 \times 12 = 8,160) \quad (8,160 \div 24,000 = \mathbf{.34})$	34%
FACS	The cost of a TV recently increased from \$160 to \$200. What was the percent of increase in the price? To compute the percent of increase, find the amount of increase (\$40) and compare this to the original number (\$160). $\frac{40}{160} = \frac{1}{4}$ or 25%	25%
HOE	Ninety percent of the 300 dentists surveyed recommended sugarless gum for their patients who chew gum. How many dentists did NOT recommend sugarless gum? $(100 - 90 = 10) \quad (300 \times .10 = \mathbf{30})$	30
Marketing (# 7)	If a dress is priced at \$129 and sales tax is 8.25%, what is the cost of the dress? $(129 \times .0825 = 10.64) \quad (129 + 10.64 = \mathbf{139.64})$	\$139.64
Tech Ed	Eddie drives a car that gets 45 miles to the gallon when traveling on the highway. If the trip from Phoenix, Arizona, to Denver, Colorado, is 765 miles, and gas costs \$3.59 per gallon, approximately how much will the drive cost Eddie? $(765 \div 45 = 17 \text{ gallons of gas}) \quad (17 \times 3.59 = \mathbf{61.03})$	\$61.03
T & I (#13)	What percent of the squares on this figure are shaded? $(8/16 = \frac{1}{2} = \mathbf{50\%})$ 	50%

More Practice with Percentages: Answer Key

1.	If a state treasury collects \$350,000,000 in tax revenue and then puts \$134,750,000 toward education, what percentage of its revenue is going toward education? (134,750,000 ÷ 350,000,000 = .385)	38.5%
2.	The cost of a TV recently increased from \$160 to \$200. What was the percent of increase in the price? To compute the percent of increase, find the amount of increase (\$40) and compare this to the original number (\$160). $\frac{40}{160} = \frac{1}{4}$ or 25%	25%
3.	A tire sale advertised 20% off on top-grade belted tires. If the list price for a particular tire is \$80, how much would you have to pay for a set of 4 new tires? Four tires at \$80 would be \$320. Now find 20% of \$320. (320 x .20 = 64 this is the amount of the reduction.) (\$320 - \$64 = \$256)	\$256
4.	Because of a new contract, the hourly wage rate was increased by 6%. If the old rate was \$6.50, what is the new rate? (6% of 6.50 = .39) The increase is \$.39. When this is added to \$6.50, the new wage is \$6.89 per hour.)	\$6.89
5.	If a sweater regularly sold at \$45 is marked down 25%, what is the sale price? (45 x .25 = 11.25) (45 - 11.25 = 33.75)	\$33.75
6.	If a color TV regularly sold at \$595 is marked down 20%, what is the sale price? (595 x .20 = 119) (595 - 119 = 476)	\$476
7.	On his diet, John's weight dropped from 200 to 178 pounds. What was the percent of decrease in his weight? (200 - 178 = 22) (22 ÷ 200 = .11)	11%
8.	A salesperson works on a 10% straight commission. If her sales for one week were \$2,480, how much did she earn? (2480 x .10 = 248)	\$248
9.	The federal government obtains funding for Social Security by collecting 6.2% of your paycheck from you and another 6.2% from your employer. If your salary is \$300 a week, how much do you pay in Social security tax? (300 x .062 = 18.60) Note: Every week, then, the government gets \$18.60 in Social Security tax from your paycheck. And it collects another \$18.60 from your employer.	\$18.60
10.	If you were earning \$400 a week and received a \$10 raise, by what percent was your salary increased? (10/400) = (1/40 = .025)	2.5%
11.	If your IQ went from 85 to 140 after reading a book, by what percent did your IQ change? (140 - 85 = 55) (55 ÷ 85 = .647)	64.7%
12.	The Atlanta Braves had a better year in 2006 than they had in 2005. In 2006 they won 70 games; in 2005 they won only 56. By what percentage did their wins increase? (70 - 56 = 14) (14/56 = 2/8 or ¼ or .25 or 25%)	25%
13.	If your pay was cut from \$55,000 to \$52,000, by what percentage did your pay decline? (55,000 - 52,000 = 3000) (3000 ÷ 55,000 = .0545 or 5.5%)	5.5%
14.	If you went on a diet and lost 35 pounds, by what percentage did your weight decline if you now weigh 100 pounds? (35 ÷ 100 = .35) (35/135 = .259)	25.9%
15.	If you left a 15% tip, how much "tip money" would you leave if the price of the meal was \$29.50? (29.50 x .15 = 4.43)	\$4.43
16.	Janet earned \$78 in tips as a waitress on Friday night. She always puts aside 12% of her tips to pay her taxes at the end of the year. How much should Janet put aside from her Friday night tips? (78 x .12 = 9.36)	\$9.36
17.	Eighteen minutes is what percentage of an hour? (18 ÷ 60 = .30)	30%
18.	A store's new Year's Sale is offering 30% off all shoes and bags. If Jo-Anne buys a bag for \$80 and a pair of shoes for \$120, what will her pre-tax total be on her purchase? (80 + 120 = 200) (200 x .30 = 60) (200 - 60 = 140)	\$140
19.	In January the cost of gas for Mr. Smith's farm equipment was \$4.20 per gallon and in October it cost \$3.57. By what percent did the price of gas decrease? (4.20 - 3.57 = .63) (.63 ÷ 4.20 = .15)	15%
20.	Multiply: 220 x 7.65%	17.05

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