Math in Context: Math for the Workplace

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Welcome!

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Math for the Workplace
Agenda

- Math Foundation Skills and Workplace Examples

- Workplace Math Skills Needed

- Math Use at Work: Surveys

- Math Games and Puzzles for Skills Practice

- Varied Math Skills Activities Examples

- How Much Material Do I Need? – Activities

- Bureau of Labor and Statistics and XP Math – Math Needed by Career

- Resources – Websites

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Math Foundation Skills and Workplace Examples

Math Foundation Skills and Workplace Examples (1)

Math foundation skills	Explanation	Workplace examples
Whole numbers	Read, write, count, round off, add, subtract, multiply, and divide whole numbers.	• Order supplies. • Take stock inventory. • Count parts. • Read serial numbers.
Integers	Read, write, add, subtract, multiply, and divide integers.	• Read temperatures. • Use survey tools. • Set up computer numerical control programs. • Measure air pressure.
Fractions	Read, write, round off, add, subtract, multiply, or divide fractions. Multiply or divide by a fraction.	• Take and record imperial measurements. • Determine tool or material sizes. • Calculate quantities.
Decimals	Read, write, round off, add or subtract, multiply, or divide decimals. Multiply or divide by a decimal.	• Handle money. • Take and record metric measurements. • Measure tolerances. • Select tool sizes.

Math Foundation Skills and Workplace Examples (2)

Math foundation skills	Explanation	Workplace examples
Percentages e.g.: 15%, 55%	Read and write percentages. Calculate the percentage that one number is of another. Calculate a percentage of a number.	• Calculate tax. • Read and write tolerances. • Adjust machine loads. • Describe in terms of a proportion of maximum capacity or an amount of progress towards completion.
Equivalent numbers e.g.: 1/2 = 0.5 = 50%	Convert between fractions, decimals, and percentages.	• Convert decimal readings on gauges to percent of output. • Convert decimals to fractions to select the correct part or size of tool. • Convert quantities of ingredients to decimals to calculate cost.
Other real numbers e.g.: $\sqrt{36}$, 9^2, 2.2×10^3, π	Use square roots, powers, scientific notation, and significant digits.	• Calculate power and current in three-phase motors. • Use square roots to calculate dimensions for a staircase. • Use powers to express the volume of tanks.
Equations and formulas	Solve problems using equations with one unknown quantity. Use formulas by inserting quantities. Solve quadratic equations.	• Determine where to place holes. • Calculate the correct angles for rigging loads. • Set food prices. • Use Ohm's law to check motor voltage.

Math Foundation Skills and Workplace Examples (3)

Math foundation skills	Explanation	Workplace examples
Rates, ratios and proportions	Use a rate comparing two quantities with different units. Use a ratio comparing two quantities with the same units. Use a proportion comparing two ratios or rates.	• Adjust tire pressure. • Mix gasoline additives. • Adjust ingredients in a recipe to make more servings. • Calculate speed and feed rates of a machine. • Read a scale drawing. • Calculate airflow rates.
Measurement conversions	Convert between customary and metric (SI) measurements. Convert to another unit within a measurement system. Convert between measurement systems or between units in one system, e.g. ft2 to yd2, yd3 to m3.	• Convert units to select wrench sizes. • Cut lengths of wire. • Mix coloring agents. • Meet product specifications. • Calculate airflow. • Use scale drawings.
Areas, perimeters and volumes	Calculate areas, perimeters and volumes. Calculate areas and volumes of shapes that are simple composites of simple, familiar shapes.	• Calculate the area or perimeter of a work surface to be painted, sodded or caulked. • Calculate the volume of gasoline additives or concrete required. • Calculate the capacity of a storage tank.
Geometry	Apply geometric concepts such as parallelism, perpendicularity and tangents.	• Find the center of a room to install fixtures. • Cut hair using angles. • Cut slopes to fabricate ramps. • Use angles to lay out patterns for materials.

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Math Foundation Skills and Workplace Examples (4)

Math foundation skills	Explanation	Workplace examples
Trigonometry	Use trigonometry to determine the size of an unknown side or angle of a triangle.	• Calculate angles for a circular staircase. • Place holes on a part. • Make bolt patterns for drilling or machine installation. • Find offsets.
Summary calculations	Calculate averages and rates other than percentages, proportions or ratios. Calculate quantities of materials.	Calculate averages for: • fuel or power consumption; • tool lifespan; • speed and feed rates; • material production; and • time needed to perform tasks.
Statistics and probability	Use statistics and probability to draw conclusions. Estimate quantities of materials.	• Estimate how much of something clients use. • Predict sales trends. • Determine the probability of equipment and parts failure. • Describe the progress of fabrication and installation tasks.

Workplace Math Skills Needed

Workplace Math Skills Needed (1)

- **Measurement and calculation:**
  - Skills used to measure and describe the physical world, for example by taking measurements and calculating area and volume.

- **Money math:**
  - Skills used in paying and receiving money on the job, for example in handling cash, making change, preparing bills, or making payments.

- **Scheduling, budgeting, and accounting:**
  - Skills used to manage time and money, for example in planning and keeping track of how you use your time and money, in choosing the products or services that offer the best value, and in using your time and money wisely.

- **Data analysis:**
  - Skills used to solve problems by analyzing and comparing numerical data.

Workplace Math Skills Needed (2)

- **Math skills needed in the workplace contain:**
    - Extraneous information to sort through.
    - Rearranging of information required to get to the answer.
    - Chained steps; sequencing is important.
- **In sum:**
    - Interpret the English (the words) in terms of math.
   - Choose the correct math tools to solve the problem.

Workplace Mathematical Situations

- **Workplace mathematical situations:**
  - Problems that are "word problems."
  - Problems are highly plausible "on-the-job" situations.

- **Workplace mathematical situations require that you:**
  - Interpret the English (the words) in terms of math.
  - Choose the correct math tools to solve the problem.
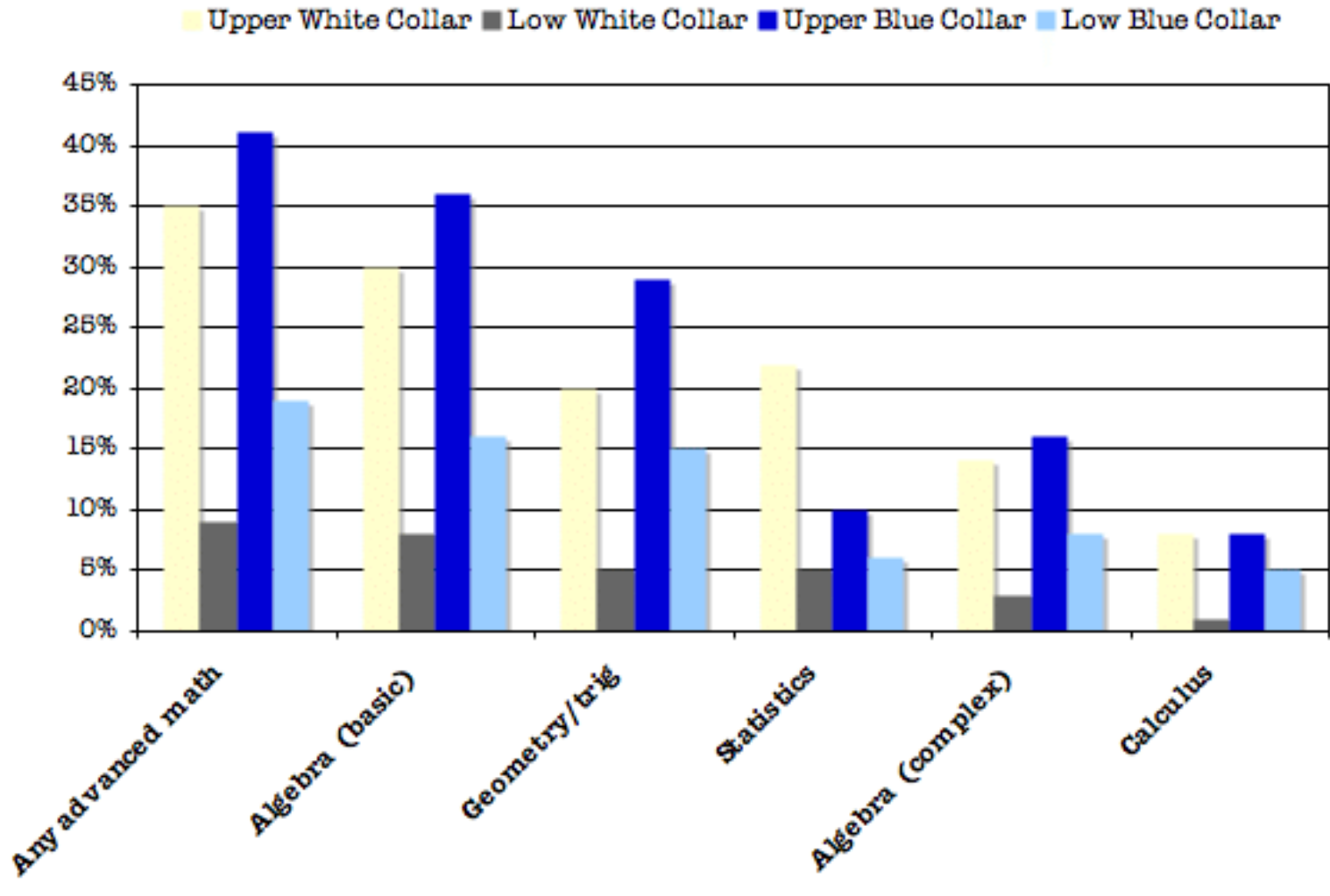
Math Use at Work: Surveys

What Percentage of Americans Actually Use Math at Work?

Data: Michael Handel, "What Do People Do at Work? A Profile of U.S. Jobs from the Survey of Workplace Skills, Technology, and Management Practices (STAMP)"

Survey data compiled by Northeastern University sociologist Michael Handel
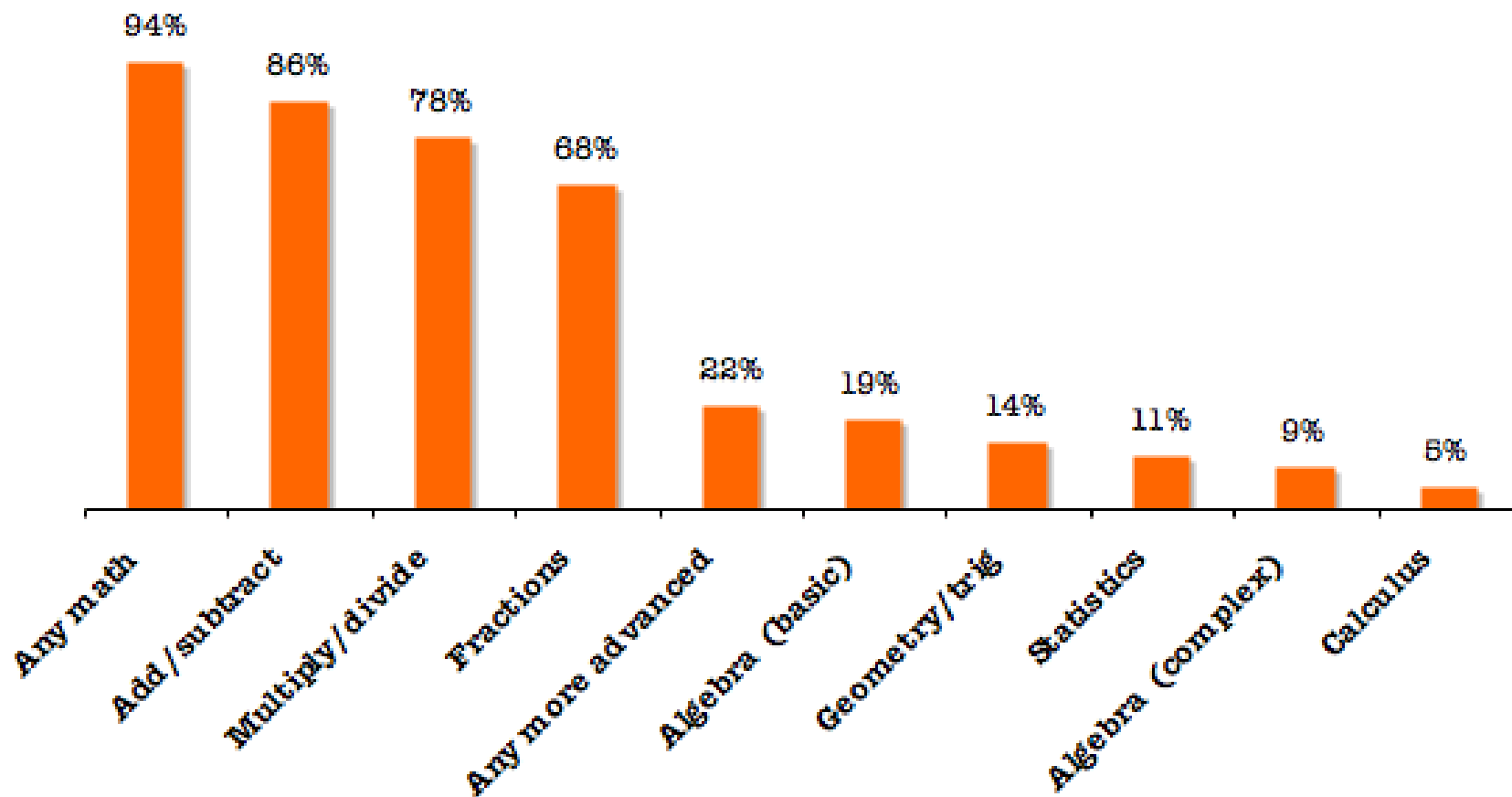
Higher-Level Math Use by Job Type

Data: Michael Handel, "What Do People Do at Work? A Profile of U.S. Jobs from the Survey of Workplace Skills, Technology, and Management Practices (STAMP)"

Survey data compiled by Northeastern University sociologist Michael Handel

Math Games and Puzzles for Skills Practice

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Math Games and Puzzles

Math interactive skills practice:

- Opens avenues for discovery of strategies for solving problems.

- Deepens understanding of numbers.

- Repetition develops computational fluency.

- Develops critical thinking, problem-solving, and strategic reasoning skills connected to contextualized practice.

Three on Three

Try to fill in the missing numbers in the puzzle below

- Use the numbers 1 through 9 to complete the equations.
- Each number is only used once.
- Each row is a math equation, and each column is a math equation.
- Remember that multiplication and division are performed before addition and subtraction.

Created with the help of http://puzzlemaker.discoveryeducation.com/MathSquareForm.asp

Games of Fifteen (1)

A game for two players:

- The object of the game is to be the first player to create a line of 3 cards that adds up to 15. The line can be vertical, horizontal, or diagonal. The line can be made up of cards placed by both players or only one taking turns.

• **Version 1:** Place the number cards face down beside the board. Players take turns to pick a card and place it in a square.
• **Version 2:** Place the number cards face up beside the board. Players take turns to choose a card and place it in a square.

Inspired by: http://www.learn-with-math-games.com/magic-square-puzzles.html
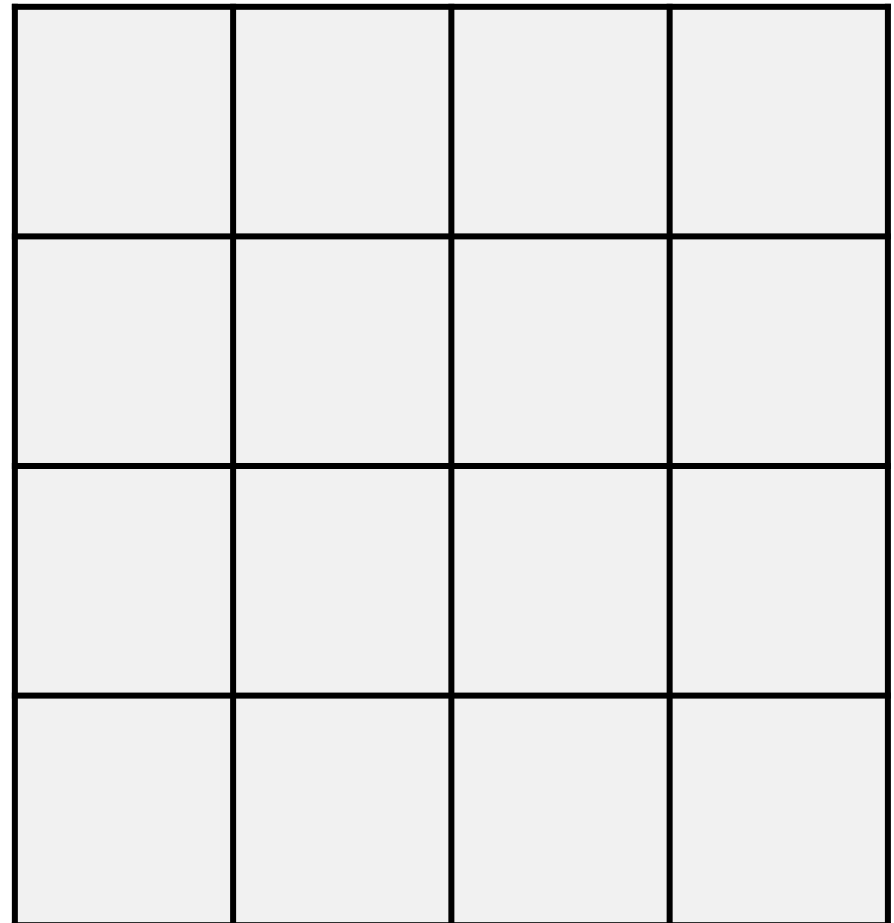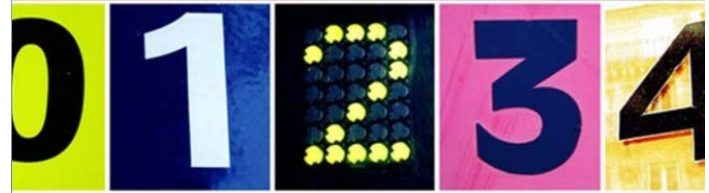
Games of Fifteen (2)

- Using the numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9.

- Place the numbers in the proper boxes within the square so that each row (vertical, horizontal, and diagonal) adds up to 15.

- Use each number only once.

Inspired by: http://www.learn-with-math-games.com/magic-square-puzzles.html
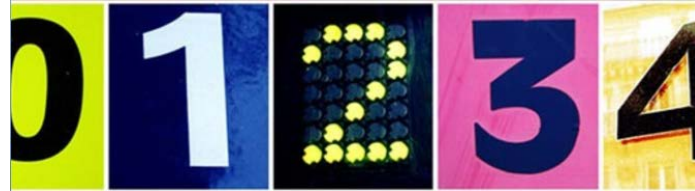
Games and Puzzles for Skills Practice
Multiplication Dominoes

Multiplication Dominoes

$$\frac{30}{6} = 5$$

$$\frac{30}{6} = 5$$

Multiplication Dominoes

Directions:
1. Mix up fraction dominos face down, have each player pick eight.
2. Keep the dominoes face down.
3. Select two or four depending on what you want to solve.
4. Turn the dominoes face up and place them in order one-by-one in the squares provided in a clockwise fashion.
5. Solve for each domino fraction.
6. Do not write in the squares provided for the answer, instead select cutout number squares to interpret your answer.
7. Your competition will check the answer and challenge it if needed, working out the result on paper or on a calculator.
8. 5 points for one correct answer and ten points for two.
9. Keep track of points and more below.

Player 1		Player 2	
Solving 1 fraction 5 points	Solving 2 fraction 10 points	Solving 1 fraction 5 points	Solving 2 fraction 10 points

Inspired by: https://sites.google.com/a/pvlearners.net/sweigand-games/twisting-dominoes

Are there any math skills practice game and/or puzzle ideas that you would like to share?

Varied Math Skills Activities Examples

Varied Math Skills Activities

Examples of activities that can be completed interactively onscreen and hard-copy:

- Reinforce a variety of math skills.

- Opened-ended questions integrating math across curriculums.

- Reach varying skill levels with the same activity.

- Activities that ensure that math instruction builds on what each student already knows.

- Examples of tools that can be used in each math content area.

Multiplication Table Activity

Multiply the column number by the row number and fill in the answer number to complete the multiplication table.

0	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Word Sort Activity

MATH WORD SORT

From the Word Bank on the other side of the page, choose at least five words with similar meanings that you can group. Choose three different groups of math words or phrases, title and explain below why they belong in each group. Complete with sentences preferred.

Word Group Title 1: _____

_____
_____
_____
_____
_____

Word Group Title 2: _____

_____
_____
_____
_____
_____

Word Group Title 3: _____

_____
_____
_____
_____
_____
_____

Word Bank

add	change (for money)	left
all together	Decrease	less than
and	decrease by	nearer
cut	Total	is equal to
both	Difference	reduce
combined	Farther	remain/remaining
twice	the result is	average
how many in all	how many more	left
is	Whole	multiply
quotient	Smaller	every
in all	how many less	so on
increased by	how much left	each
split	times (as much)	yields
is the same as	Increase	less than
in all	More	nearer
of	more than	reduce
product of	Plus	remain/remaining
divide	Sum	Total

Underground Contamination

Table 1: Site A

Depth	Benzene	Dioxin	Asbestos
10 feet	0.02	0.31	0.01
20 feet	0.15	0.26	0.02
30 feet	0.18	0.02	0.02
40 feet	0.03	0.05	0.12
50 feet	0.01	0.03	0.29

Table 2: Site B

Depth	Benzene	Dioxin	Asbestos
10 feet	0.28	0.45	0.04
20 feet	0.37	0.29	0.07
30 feet	0.16	0.12	0.11
40 feet	0.04	0.03	0.28
50 feet	0.02	0.01	0.56

Recipe Conversion Activity

Recipe for Four - Steak for One
Breaded Steak recipe (Bistec Empanizado) - serves 4

4 steaks (1/4 inch thick) _____
1/2 cup onion, chopped _____
1 tbsp fresh garlic, minced _____
1/4 cup sour orange juice _____
1/4 tsp salt _____
4 eggs, beaten well _____
1 cup finely ground crackers, salt to taste _____
1/2 onion, sliced into rings _____
Olive oil _____

Sprinkle steaks with chopped onion, garlic, orange juice, and salt. Rub garlic into meat. Marinate for a few hours in the refrigerator. Brush off the onion pieces and dip each steak into the egg to make sure it's fully coated. Dip the steak into the crackers, making sure that the ground crackers completely cover the steak. Fry the steaks in cooking oil on medium heat until golden brown and well done. Serve with a few onion rings.

A man has to convert a recipe his mother gave him for breaded steaks. The recipe that serves four will have to be changed to serve one.
A man's cooking utensils are limited. There are no tablespoons and measuring cups in this house. Teaspoons and shot glasses have to be used as substitutes.

Rewrite the recipe so the measured ingredients only make enough breaded steak to serve one. Measurement conversions needed below.
1 US tablespoon = 3 US teaspoons
One shot = one ounce
One cup = 8 ounces

Sale Price and Coupon Activity

Formula = two steps:

Regular Selling Price x Markdown   = Sale Price
Sale Price x Coupon Markdown Rate = Final Sale

	Item	Regular Selling Price	X	Markdown Rate	=	Markdown	Sale Price	Coupon Mark-down 25%	Price After 25% Coupon = Final Sale Price
1.	Ralph Lauren Cologne	$110.00	X	0%	=				
2.	Skechers Shoes	$69.99	X	10%	=				
3.	Nike Socks 6 pack	$12.99	X	20%	=				
4.	Carry-on Luggage	$59.00	X	10%	=				
5.	Fossil Watch	$90.00	X	10%	=				

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Formulas: Working with Shapes Activity

Name the Shape	Draw the Shape	Perimeter	Area or Volume	Surface Area	Weight

Are there any workplace math skills activity ideas that you would like to share?

How Much Material Do I Need? - Activities

How Much Material Do I Need?

Algebra, formulas, word problems, measurement

- The main objective is to engage students with math skills needed in various occupations, especially in manufacturing, construction, and health care workplaces.

- Students will learn to apply formulas and mathematical concepts to real-life situations.

- Health care professionals use a variety of measurements and formulas to determine the right dose or the amount of a product.

- Review formulas and shapes and compare/contrast perimeters, areas, volumes, and measurements.

How Much Material Do I Need? – Activities (1)

- **Objectives**: The main objective is to engage students with math skills needed in various occupations, especially in manufacturing, construction, and health care workplaces. Construction activities will serve as examples to illustrate Students will learn to apply formulas and mathematical concepts to real-life situations. How many of you have ever started and completed a home improvement project? Students will learn the various math skills necessary to complete such home repair projects as painting, wallpapering, tiling, laying flooring, etc. Students will learn how to save money on everyday projects and keep within budgets set for these projects**.**

- **Level/Subject: ABE1-6/Math – algebra, formulas, word problems, measurement**

- **Materials:** Tactile items that relate to paper activity will help in instruction. For example: tape measure, ruler, medicine cups, etc. A calculator may aid in the computation of numbers, but it is up to the instructor whether or not one should be used. Newspaper ads for paint, flooring, tiles, carpet, etc. with pricing and measurements. HSE Formulas sheet, overheads, pictures, and chalk board may also be used.

How Much Material Do I Need? (2)

- **Procedure:** Review formulas and shapes and compare/contrast perimeters, areas, and volumes. Allow students to work together on projects. Have students verbalize and work on paper with the problem-solving process first before working the calculations on calculators. Bring in rulers and other measuring tools. Have students estimate and then calculate with formulas on the HSE Formula page needed for each example area question using simple shapes. Later, have students calculate how much it would cost for the materials and even labor to complete the work. Develop projects for students in as many home repair real-life situations as it takes to grasp the formula skills. Use painting, wallpapering, tiling, laying flooring, etc.

- **Follow-Up**: Have students find and use the correct formulas to use for real-life situations. Work with students to practice all the formulas on the HSE Formulas sheet. Work on a number of examples. Work with students to further skills in volume and finance formulas. Develop projects that deal with skills from how much fencing, to how much interest. Teach students how important it is to measure accurately and save money on projects.

Floor Area – Square feet and yards
Find the floor area in square feet for each of the following floor plans.
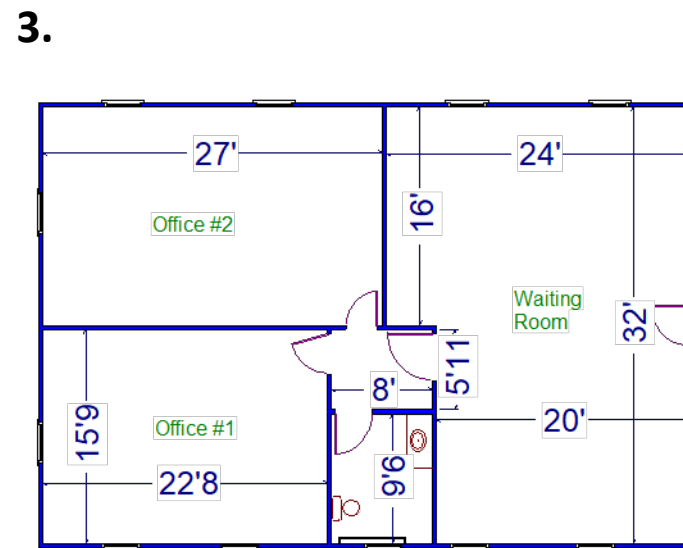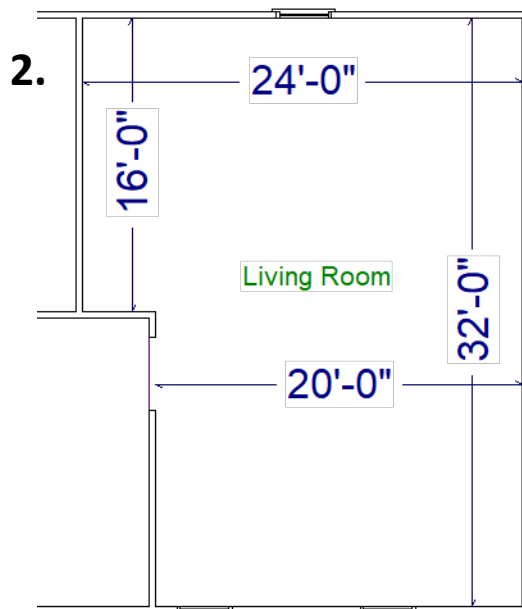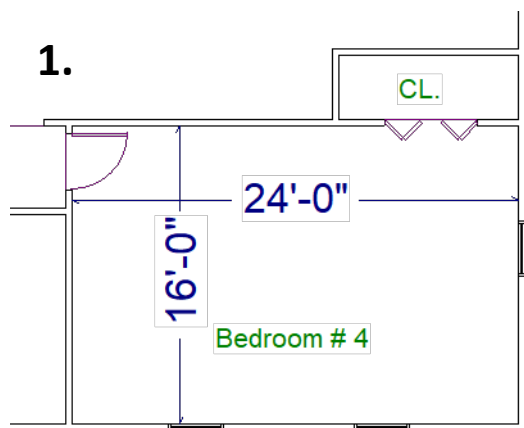## *Omit the closet area in #1 and the bathroom area in #3 Floor Plans.*

Formula for area of a rectangle: A = L x W

Floor plan 1. _____   Floor plan 2. _____   Floor plan 3. _____

Find the floor area in square yards for each of the following floor plans.
Omit the closet area in #1 and the bathroom area in #3.

One square yard = 9 square feet

Floor plan 1. _____   Floor plan 2. _____   Floor plan 3. _____

1.

CL.

24'-0"

16'-0"

Bedroom # 4

2.

24'-0"

16'-0"

Living Room

32'-0"

20'-0"

3.

27'

Office #2

24'

16'

Waiting Room

32'

15'9

Office #1

8'

5'11

20'

9'6

22'8

How Much Paint?

The Perez family wants to paint two bedrooms' walls and ceilings. To keep costs low, they want to finish the project with not a lot of leftover paint. The two rooms are identical in size, so we only need to calculate the area to be painted in one room and multiply it by two. To calculate the amount of paint you'll need for any project, you must come up with the square footage to be covered. Below are some illustrations to help with visualization and calculations. The floor plan has the dimensions for each numbered wall and ceiling. Use the spaces below to record measurements and solution. Round to the nearest foot. To make sure you have enough paint, do not subtract any square footage for windows and doors unless they significantly reduce the square footage of that wall. One gallon of paint generally covers about 400 square feet.

Formula: Area = Length x Width   Width

Length
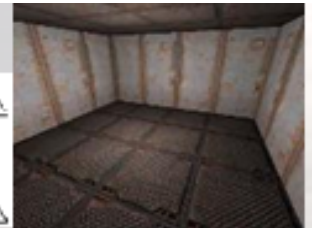
Using all the information provided on this page. How many gallons of paint will the Perez Family have to buy to complete their project? Remember to use all information and draw to help evaluate.

Wall 1 width: _____

Wall 2 width: _____

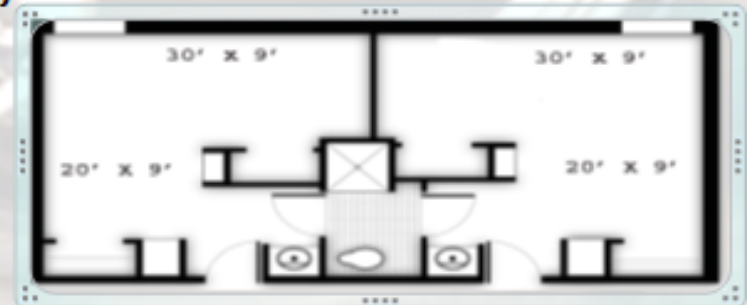Wall 3 width: _____

Wall 4 width: _____

Wall height: _____

Ceiling:

Ceiling length: _____

Ceiling width: _____

Area to be painted: _____

Number of gallons needed: _____

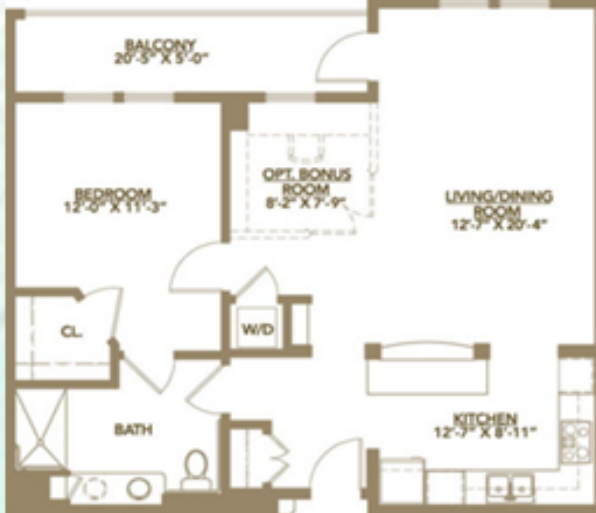30' X 9'   30' X 9'

20' X 9'   20' X 9'

How Much Carpet?

Mike wants to carpet their living/dining room area. They want to come up with a quick estimate to make sure they can afford the project and have enough carpet to finish the project. Calculating the amount of carpet you'll need and what it costs means coming up with the square footage and multiplying this measurement by the price per square yard. The price of carpet is usually expressed in square yards. _A yard is 3 feet, so a square yard equals 3 feet by 3 feet, or 9 square feet_.

Find the area in square footage for the living/dining room. After converting the square yards, calculate how much the carpeting will cost. _One square yard of carpeting is $9.99_. Below are some illustrations for calculations. The floor plan has the dimensions needed to calculate the square footage of the area to carpet. You should round up to the nearest foot. The area formula below will be helpful.

Formula for area of rectangle: $A = L \times W$ and square: $A = Side^2$

Rectangle Width

Length

Width: _____

Length: _____

Square Side

Side

Square feet needed: _____

Square yards needed: _____

How Much Wood Flooring?

The Wilson's living/dining area needs new flooring. The carpeting has been removed and will be replaced with wood flooring. The area of flooring the Wilson's are replacing does not have any irregular dimensions. However, if your room has irregular dimensions, divide it into squares or rectangles and use the area formula to solve in each area, then add all the totals. How many square yards of wood flooring will they need to replace the flooring in the living and dining area? The wood flooring is sold in square yards, so you have to convert the measurement from square feet to square yards. (Square yard =1,296 square inches or 9 square feet.)

Rectangle Area Formula
Length x Width

Width

Length

LIVING   DINING
15'-6" X 13'-8"

BEDROOM
12'-4" X 11'-0"

CLOSET

KITCHEN
10'-10" X 7'-1"

ENTRY   CL

BATH

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Width: _____

Length: _____

Square yards needed:
_____

Square feet needed:
_____

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Bureau of Labor and Statistics and XP Math – Math Needed by Career

Bureau of Labor and Statistics and XP Math

Using Bureau of Labor and Statistics and XP Math websites, advise students math needed by career

- I use the following sites to construct informational cards that show students the types of math needed for individual career choices.

  - Use https://www.bls.gov/data/#occupational

  - Use http://www.xpmath.com/careers/math_jobs.php

- With these career lists, we can teach job readiness skills and practice all the needed math skills with help from various sites throughout the internet.

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Resources – Websites

This webinar contains links to resources created and maintained by outside organizations that may be useful to the reader. The Department is not responsible for the accuracy of the information contained in those outside resources.

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Resources/References – Games and Puzzles

- http://www.mathopolis.com/index.php
  Games designed to improve your mental power
- http://www.math-play.com/Pythagorean-Theorem-Game.html
  In this Pythagorean Theorem game, you will find the unknown side in a right triangle
- http://puzzlemaker.discoveryeducation.com/MathSquareForm.asp
  Create your own math square puzzle free
- http://www.rickyspears.com/rulergame/
  The ruler game - learn to read a ruler

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Resources/references – Interactive Math Tools

- http://www.aplusmath.com/
  Interactive math resources for teachers, parents, and students featuring free math worksheets, math games, math flashcards, and more
- http://www.bbc.co.uk/skillswise/math
  Practical, common-sense math for adults
- http://www.math.com/
  Power to help solve everyday problems
- http://math2.org/
  English and Spanish math reference tables, links, math message board, and more
- http://mathematics.hellam.net/
  Flash-based interactives
- http://www.mathsisfun.com/data/data-graph.php
  Make a bar graph, line graph, pie chart, dot plot or histogram, then print or save it
- http://www.mcedservices.com/math/mathindex.htm
  Improve math vocabulary and practice basic math through geometry

Resources/references –Interactive Math Tools (Cont.)

- http://www.metric-conversions.org/
  Metric conversion charts and calculators for metric conversions
- http://www.mcedservices.com/math/mathindex.htm
  Improve math vocabulary and practice basic math through geometry with "The Language of Math," a site created by ESL teacher Charles LaRue
- http://nces.ed.gov/nceskids/createagraph/
  Create a graph
- http://nlvm.usu.edu/en/nav/vlibrary.html
  National Library of virtual manipulatives
- http://www.onlinemathlearning.com
  Interesting quizzes, practice, homework help, and other materials to keep you occupied; or fun facts, games, puzzles, and other cool stuff
- http://www.saab.org/mathdrills/md.cgi
  Mathematics Tests and Drills

Resources/references –Interactive Math Tools (Cont.)

- http://www.shodor.org/interactivate/activities/PythagoreanExplorer/
  Interactive Pythagorean explorer
- http://www.sosmath.com/
  Free resource for math review material from algebra to differential equations
- http://www.thatquiz.org/
  English, Spanish, French, and more – math interactive quizzes, flash-based interactivities
- http://www.timetoast.com/timelines/pythagorean-theorem--2
  Historical math timelines
- http://www.vendian.org/mncharity/dir3/paper_rulers/
  Some printable paper rulers
- http://www.visualfractions.com/
  Learn about fractions for free, no login, no ads
- http://zonalandeducation.com/mmts/mmts.html
  More mathematics than science

Resources/References:
Printable Worksheets and Cards

- http://www.learningtrends.com/
  GED, HISET, and TASC math review for the new test
- http://www.senteacher.org/Home/
  SEN Teacher has printables, specialist links, free software downloads, and search tools for all types and levels of special and remedial education
- http://worksheetsdirect.com/members/
  Free math worksheets and videos for math help
- http://www.studystack.com/category-8
  Math flashcards

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- Bestimation: https://lincs.ed.gov/professional-development/resource-collections/profile-254

- Instructional videos and resource packs: https://lincs.ed.gov/professional-development/resource-collections/profile-1027

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Thank you!

Please complete the survey:
http://www.surveygizmo.com/s3/2000536/LINCS-Customer-Satisfaction-Survey-One-Off

- Date: TBD

- Presenter: Michael Matos

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for further discussion!
https://community.lincs.ed.gov/**