

# **PRE-APPRENTICE TRAINING**

## **A TEST PREPARATION MANUAL FOR THE SKILLED TRADES**

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&  
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PRE-APPRENTICE TEST

DIRECTED NUMBERS

Time: 10 Minutes

Directions: Do the indicated operations.

Answers

1.  $(6) + (-8) =$

\_\_\_\_\_

2.  $(-9) + (15) =$

\_\_\_\_\_

3.  $(-19) + (-4) =$

\_\_\_\_\_

4.  $(5) - (-3) =$

\_\_\_\_\_

5.  $(29) - (-44) =$

\_\_\_\_\_

6.  $(-3.3) - (-4.2) =$

\_\_\_\_\_

7.  $(4.5) - (+3.8) =$

\_\_\_\_\_

8.  $(450) - (121) + (60) - (-32) =$

\_\_\_\_\_

9.  $(-852) + (-342) - (-124) =$

\_\_\_\_\_

10.  $(5) \times (4) =$

\_\_\_\_\_

11.  $(6) \times (-9) =$

\_\_\_\_\_

12.  $(-12) \times (-44) =$

\_\_\_\_\_

13.  $(-\frac{3}{5}) \times (\frac{5}{20}) =$

\_\_\_\_\_

14.  $(4.25) \times (-3.75) =$

\_\_\_\_\_

15.  $(64) \div (-8) =$

\_\_\_\_\_

16.  $(-32\frac{1}{2}) \div (2.5) =$

\_\_\_\_\_

17.  $(-6.8) \div (-4) =$

\_\_\_\_\_

18.  $(-\frac{1}{8}) \div (-\frac{1}{16}) =$

\_\_\_\_\_

19.  $(7.5) \div (-1\frac{1}{4}) =$

\_\_\_\_\_

20.  $\frac{(-6) + 4}{(3) (-5)} =$

\_\_\_\_\_

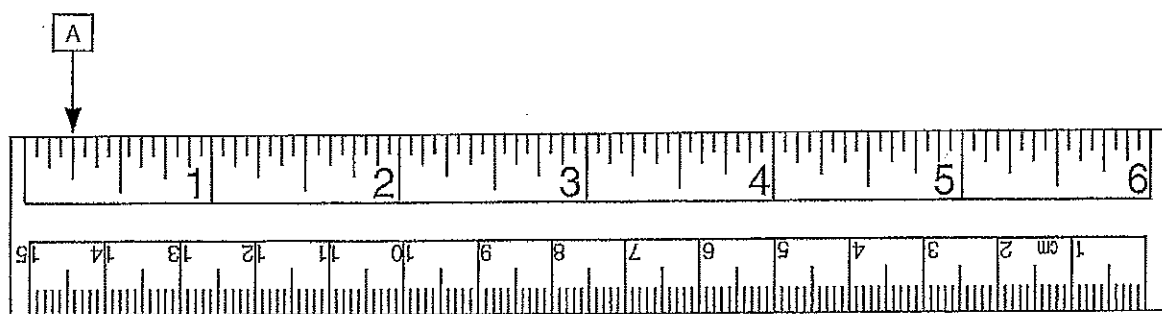
PRE-APPRENTICE TEST

READING THE RULER

Time: 20 minutes

1. Locate the following English measurements on the ruler. Label your answers as in the example. A

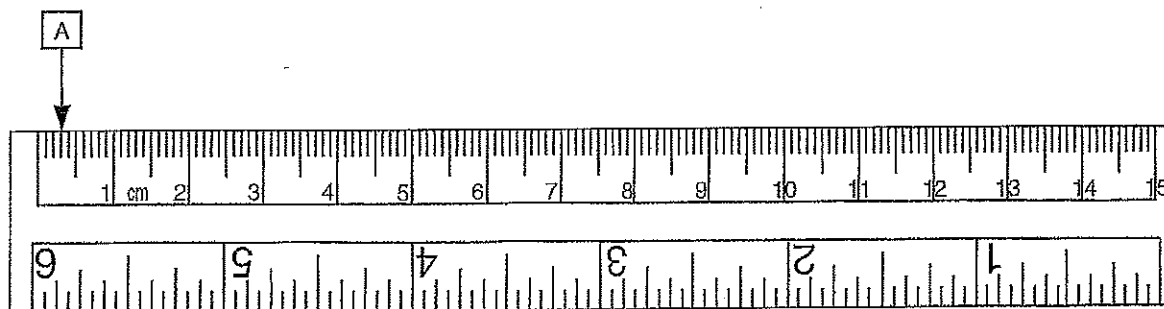
- |                      |                        |                       |
|----------------------|------------------------|-----------------------|
| A. $\frac{1}{4}$ in  | E. $1\frac{13}{16}$ in | I. $3\frac{7}{8}$ in  |
| B. $\frac{9}{16}$ in | F. $2\frac{1}{8}$ in   | J. $4\frac{3}{8}$ in  |
| C. $1\frac{1}{8}$ in | G. $2\frac{1}{2}$ in   | K. 5 in               |
| D. $1\frac{1}{4}$ in | H. $3\frac{3}{4}$ in   | L. $5\frac{1}{16}$ in |



Not to Scale

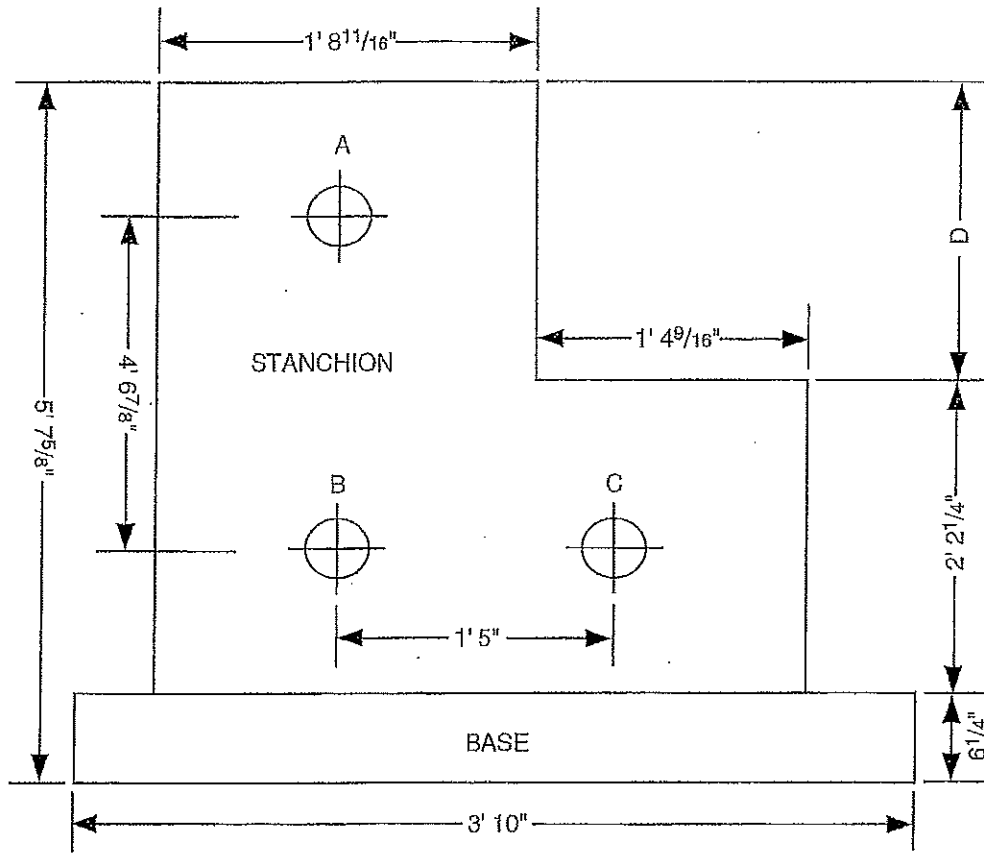
2. Locate the following metric measurements on the ruler. Label your answers as in the example. A

- |           |           |            |
|-----------|-----------|------------|
| A. 3 mm   | E. 4.2 cm | I. 10.7 cm |
| B. 1 cm   | F. 53 mm  | J. 121 mm  |
| C. 15 mm  | G. 7.9 cm | K. 14.8 cm |
| D. 2.6 cm | H. 102 mm | L. 0 cm    |



Not to scale

Use the following drawing to answer questions 3 through 9:



Answers

3. Find the height of the stanchion without the base. 3. \_\_\_\_\_
4. If the stanchion is centered on the base, how much does the base extend on each side? 4. \_\_\_\_\_
5. Solve for dimension D. 5. \_\_\_\_\_
6. Find the perimeter of the stanchion without the base. 6. \_\_\_\_\_
7. If each hole has a diameter of 2", find the distance between the inside edges holes A and B. 7. \_\_\_\_\_
8. Find the distance to the outside edges of holes B and C given that both holes have a diameter of 2". 8. \_\_\_\_\_
9. If the center of hole B is 12 inches above the top of the base, how far is the center of hole A above the same point? 9. \_\_\_\_\_

**PRE-APPRENTICE TEST**  
**RATIOS, PROPORTIONS AND PERCENTS**

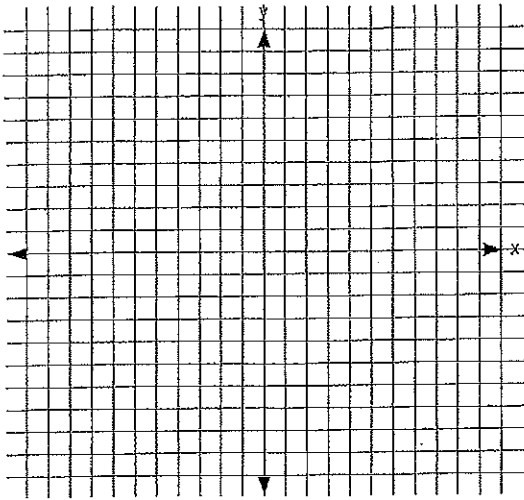
Time: 15 Minutes

Answers

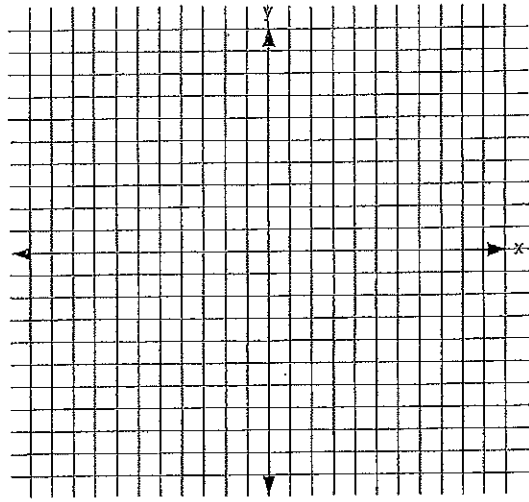
1. 8% of 11 = \_\_\_\_\_
  
2. There are 21 pencils and 9 pens in a box, what is the ratio of pencils to pens? \_\_\_\_\_
  
3. If a dozen toggle bolts cost \$1.44, how much will 5 toggle bolts cost? \_\_\_\_\_
  
4. A pattern calls for 5 yards of material plus 5% more to match print.  
How much material will you need to buy? \_\_\_\_\_
  
5. The material used for the above problem normally sells for \$4.98 a yard.  
If the material needed for the above problem is purchased during a  
20% off the original price sale, about how much will it cost? \_\_\_\_\_
  
6. What is 4% of  $\frac{1}{4}$ ? \_\_\_\_\_
  
7. If, on the average, two out of every 18 cars are red. About how many  
red cars would you expect to count in a parking lot containing 46 cars? \_\_\_\_\_
  
8. A team won 96 games and lost 14. What is the ratio of wins to the total  
of games played? \_\_\_\_\_
  
9. If 48 of the 54 workers in a plant are male, what percent of the workers  
are female? \_\_\_\_\_
  
10. What is the ratio of female workers to the total number of workers in the  
above problem? \_\_\_\_\_
  
11. A paste mix calls for 3 parts powder to 5 parts of water. How much water  
must be added to  $2\frac{1}{4}$  gallons of powder? \_\_\_\_\_
  
12. A package boasts that it contains 25% more. If the original package  
weighed 12 oz., how much more is in the new package? \_\_\_\_\_

Graph the following equations. Each equation should be graphed on its own set of axes.

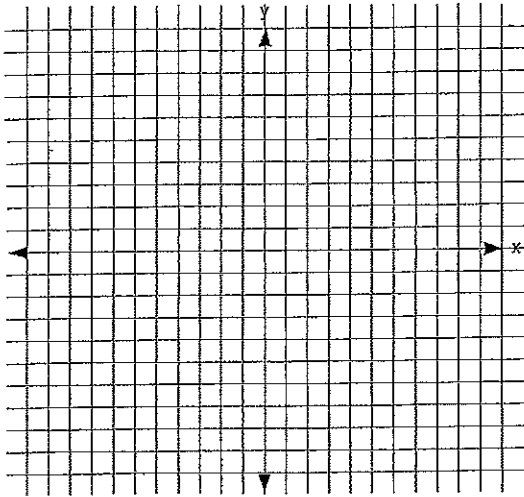
26.  $-x + y = -4$



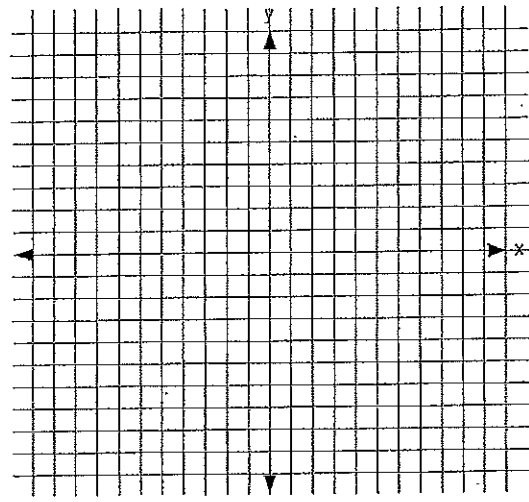
29.  $2x = -8y$



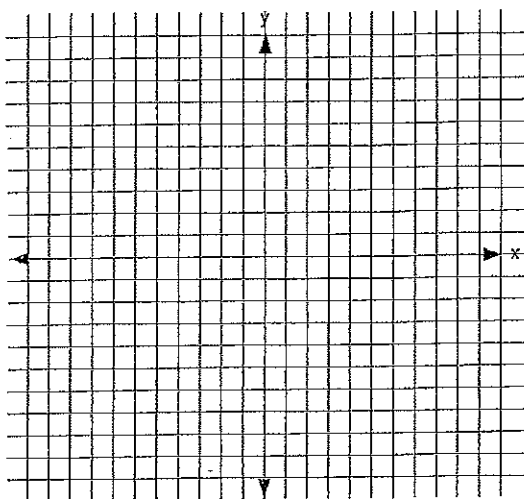
27.  $y = -5$



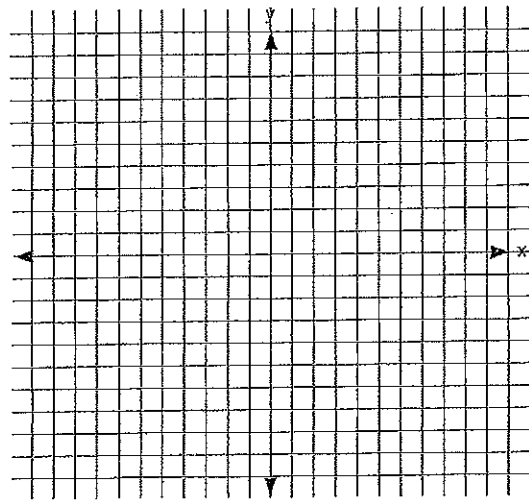
30.  $12x = -60$



28.  $-16 = x - 19$



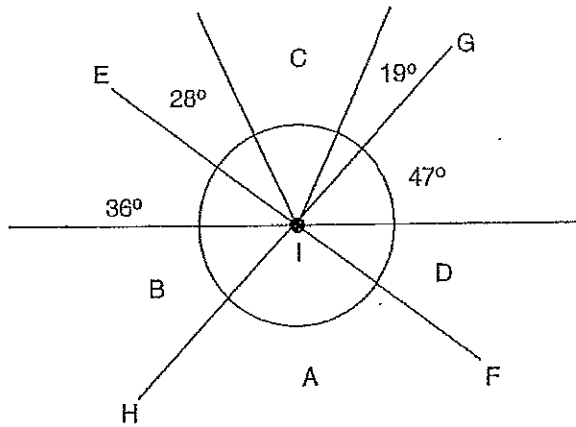
30.  $6x = 36y$



PRE-APPRENTICE TEST (continued)

GEOMETRY

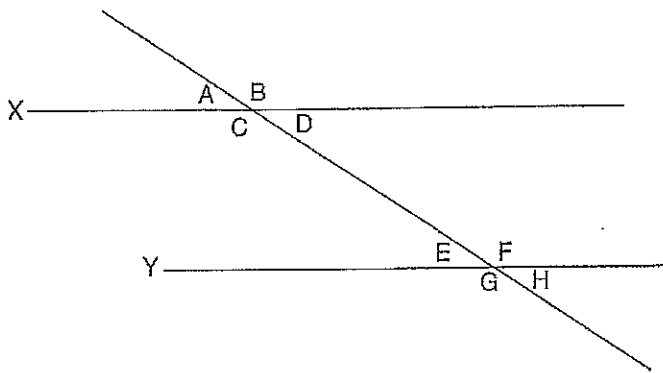
12.



Given that:  
EF and GH are straight lines  
and Point I is the center of  
the circle

- $\angle C =$  \_\_\_\_\_
- $\angle A =$  \_\_\_\_\_
- $\angle B =$  \_\_\_\_\_
- $\angle D =$  \_\_\_\_\_

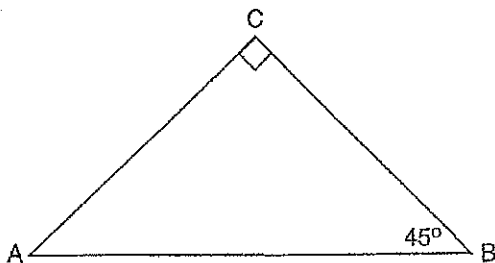
13.



$X \parallel Y$

- $\angle A = 30^\circ$
- $\angle B =$  \_\_\_\_\_
- $\angle C =$  \_\_\_\_\_
- $\angle D =$  \_\_\_\_\_
- $\angle E =$  \_\_\_\_\_
- $\angle F =$  \_\_\_\_\_
- $\angle G =$  \_\_\_\_\_
- $\angle H =$  \_\_\_\_\_

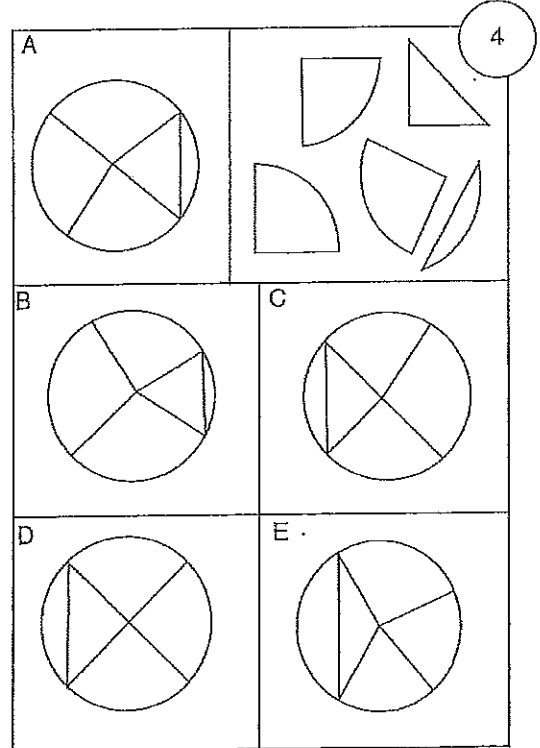
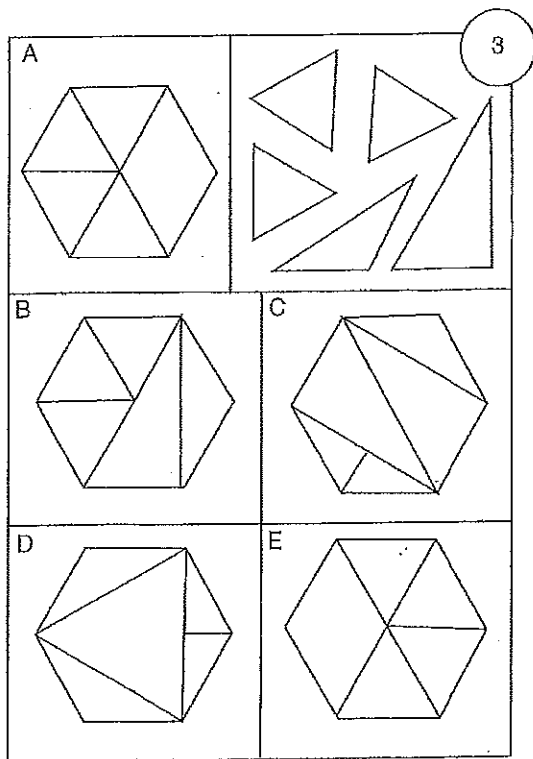
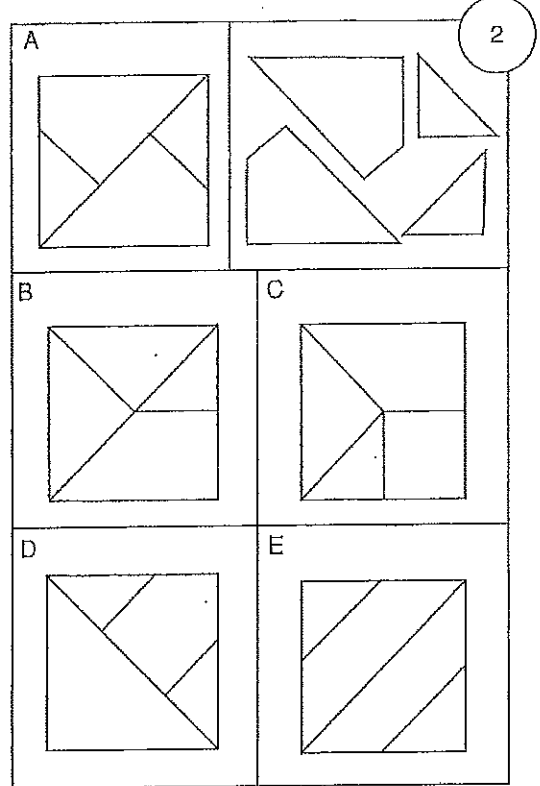
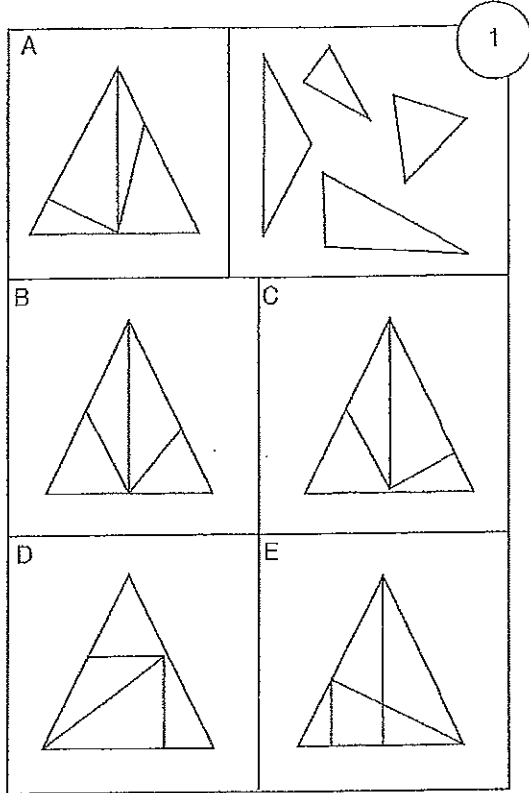
14.



- Line CB = 10" \_\_\_\_\_
- $\angle CAB =$  \_\_\_\_\_
- Line CA = \_\_\_\_\_

TIMED TEST Time - 6 Minutes

Circle the letter of the drawing which best matches the pieces in the numbered square.





**PRE-APPRENTICE TEST**  
**ALGEBRA, FACTORING AND SEQUENCES**

Time: 28 Minutes

Solve for the unknown:

1.  $-67 + x = 33$

2.  $y + 22.25 = 22.27$

3.  $1440 = 16a$

4.  $2\frac{1}{2} = b/1.6$

5.  $a/2 = \frac{1}{2}$

6.  $x/4 = 4/x$

7.  $5/x - 6 = 4$

8.  $ax/c = y$  for  $x$

9.  $n/x = y/d$  for  $x$

10.  $3(x + 2) = x + 20$

Directions: Multiply, factor or find the next number in the sequence problems.

11. Factor  $9m + 3$

12. Factor  $6a^2 - 2a$

13. Factor  $2c^2 - c - 6$

14. Multiply  $(x - y)(x + y)$

15.  $3 - 5 - 9 - 15 - 23 -$

16. Factor  $2z^2 + z - 3$

17. Multiply  $(2m + 1)(m - 2)$

18.  $5 - 10 - 20 - 35 - 55 -$

19. Factor  $3m^3 + 9m^2 - 18m$

20. Multiply  $(3b - 2)(b - 2)$

21.  $7 - 8 - 9 - 11 - 13 - 16 - 19 -$

22. Multiply  $(5k + 1)(k - 3)$

23.  $12 - 14 - 13 - 15 - 14 - 16 -$

24.  $1 - 20 - 2 - 19 - 3 - 18 -$

25. Factor  $7t^2 - 17t + 6$

Answers

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

Answers

11. \_\_\_\_\_

12. \_\_\_\_\_

13. \_\_\_\_\_

14. \_\_\_\_\_

15. \_\_\_\_\_

16. \_\_\_\_\_

17. \_\_\_\_\_

18. \_\_\_\_\_

19. \_\_\_\_\_

20. \_\_\_\_\_

21. \_\_\_\_\_

22. \_\_\_\_\_

23. \_\_\_\_\_

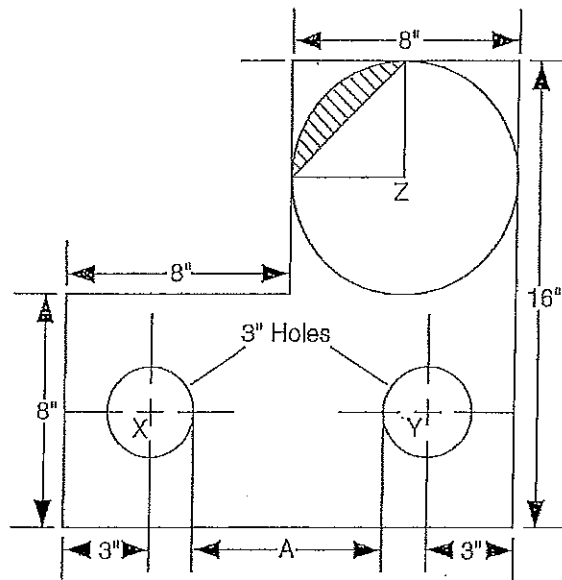
24. \_\_\_\_\_

25. \_\_\_\_\_

PRE-APPRENTICE TEST

GRAPHIC MATH

Time: 15 Minutes



Use above drawing for questions 1-6.

Answers

1. What is the center-to-center distance between circles x and y?
  - a. 7 in
  - b. 9 in
  - c. 10 in
  - d. none
2. Find dimension A.
  - a. 7 in
  - b. 9 in
  - c. 10 in
  - d. none
3. Find the area of circle z to the nearest tenth (use  $\pi = 3.14$ ).
  - a. 50.2 sq in
  - b. 254.3 sq in
  - c. 12.6 sq in
  - d. none
4. Find the perimeter of circle x.
  - a. 18.84 in
  - b. 9.42 in
  - c. 4.71 in
  - d. none
5. Find the area of the shaded portion of circle z (use  $\pi = 3.14$ ).
  - a. 1.72 sq in
  - b. 1.57 sq in
  - c. 42.24 sq in
  - d. none
6. Find the perimeter around the outer border of the drawing in feet to the nearest tenth.
  - a. 4.7 feet
  - b. 5.3 feet
  - c. 64.0 feet
  - d. none

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

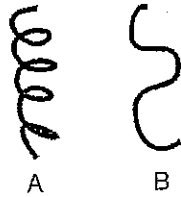
PRE-APPRENTICE TEST

ELECTRICAL

TIME 6 Minutes

\_\_\_\_\_ 1. Which non-insulated copper wire offers less resistance?

- a. A
- b. B
- c. Equal

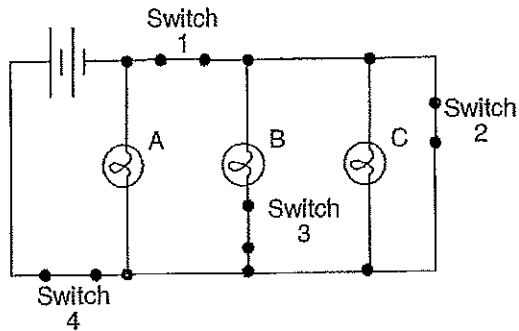


\_\_\_\_\_ 2. Which material is a better conductor of electricity?

- a. Penny
- b. Glass Bottle
- c. Wooden Dowel
- d. Cotton String

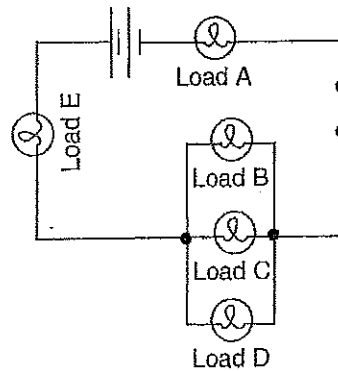
\_\_\_\_\_ 3. If switches 2 and 3 are opened which bulbs will remain lit?

- a. A, B
- b. B, C
- c. A, C
- d. None



\_\_\_\_\_ 4. If bulb C burns out, name all of the bulbs that will remain lit.

- a. A, E
- b. A, B, E
- c. A, B, D, E
- d. None



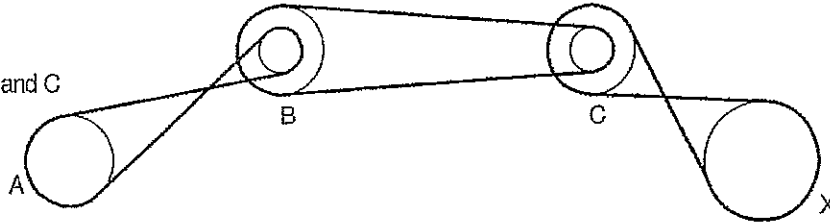
PRE-APPRENTICE TEST  
MECHANICAL

TIME: 10 minutes

Answer

1. Which direction will pulley X be going?

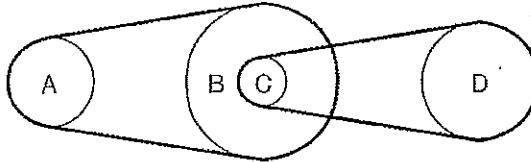
- a. Same as B
- b. Same as C
- c. Same as A
- d. Same as B and C



1. \_\_\_\_\_

2. Which pulley will turn fastest?

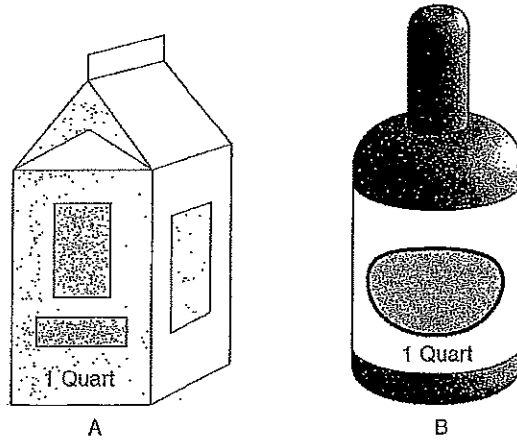
- a. Pulley A
- b. Pulley B
- c. Pulley C
- d. Pulley D



2. \_\_\_\_\_

3. Which holds more?

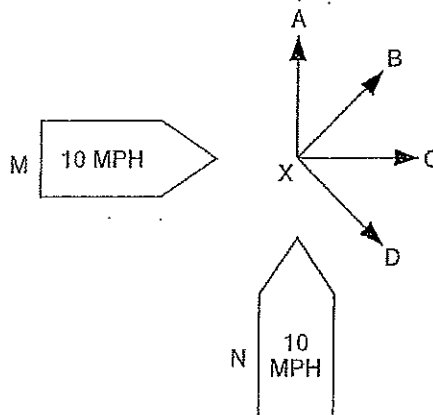
- a. Container A
- b. Container B
- c. Equal



3. \_\_\_\_\_

4. In which direction will boat M go if the two boats collide at point X?

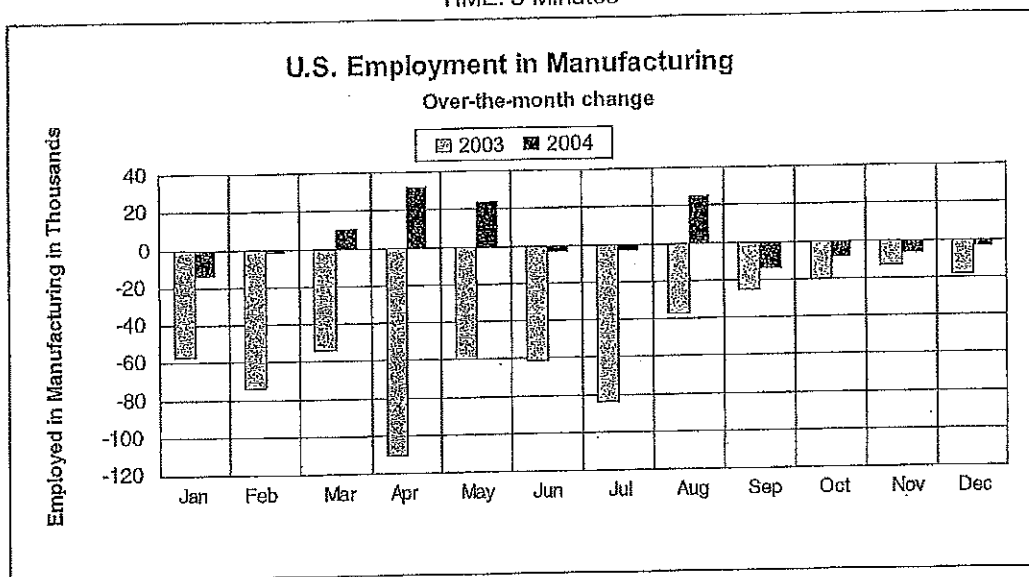
- a. A
- b. B
- c. C
- d. D



4. \_\_\_\_\_

## EXERCISE 1

TIME: 5 Minutes



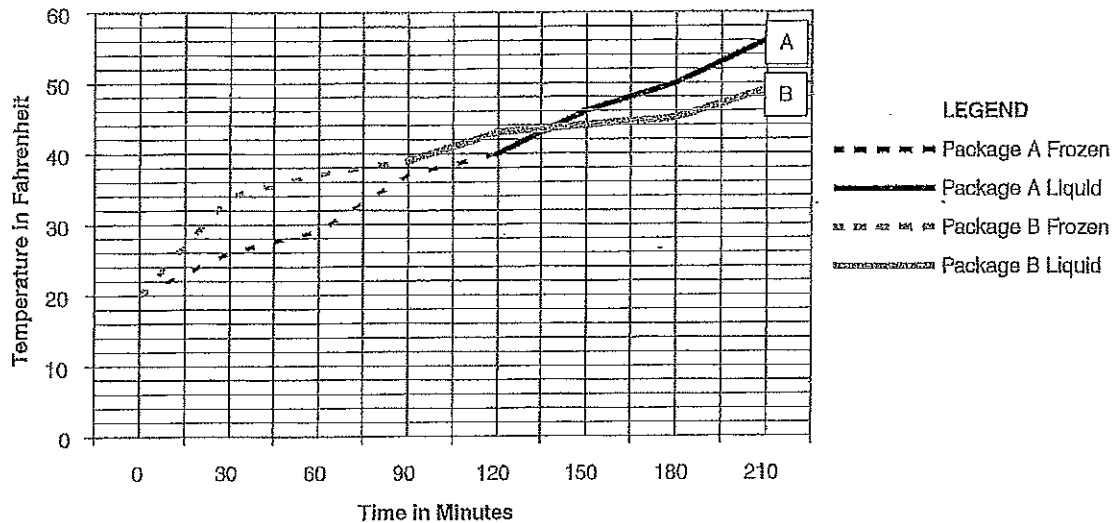
Use the above graph to answer questions 1-5 below:

1. The information given in the chart can best be described as:
  - a. Total number of people employed in manufacturing jobs in the U.S. for the years 2003 and 2004 month-by-month.
  - b. New positions available in manufacturing jobs in the U.S. for the years 2003 and 2004 month-by-month.
  - c. The gain or loss in the number of manufacturing jobs in the U.S. for the years 2003 and 2004 month-by-month.
  - d. The loss of jobs due to overseas competition in manufacturing jobs in the U.S. for the years 2003 and 2004 month-by-month.
  - e. None of these
  
2. Which month and year shows the greatest decline in manufacturing employment?
  - a. 04/2003
  - b. 04/2004
  - c. 02/2003
  - d. 02/2004
  - e. None of these
  
3. Would you say that the increases in employment for the year 2004 make up for the losses sustained in 2003?
  - a. YES
  - b. NO
  
4. Approximately how many manufacturing jobs were gained or lost in August of 2004?
  - a. 250,000 gained
  - b. 25,000 lost
  - c. 250 gained
  - d. 2,500 lost
  - e. None of these
  
5. Which of the following statements can be concluded from the graph?
  - a. There was a gradual decrease in the number of people employed in manufacturing jobs for the year 2003.
  - b. There were 60 fewer people employed in manufacturing jobs in May of 2003.
  - c. The number of people employed in manufacturing jobs in June of 2003 was greater than the number of people employed in manufacturing jobs for the same month in 2004.
  - d. Every month in the year 2003 shows a loss of employment in manufacturing jobs.
  - e. None of these.

EXERCISE 2

TIME: 6 Minutes

FREEZER PACK TEST



Use the above drawing to answer the following questions 1-5:

1. What was the temperature of package A at the start of the test?
  - a. 0° F
  - b. 10° F
  - c. 15° F
  - d. The same as Package B
  - e. None of the above
2. At what time did Package B become liquid?
  - a. 30 minutes after Package A liquefied
  - b. 30 minutes before Package A liquefied
  - c. At the same time Package A liquefied
  - d. 2 hours after the start of the test
  - e. None of the above
3. At what temperature does the Package A line cross over the Package B line?
  - a. Between 40° F and 50° F
  - b. Between 30° F and 40° F
  - c. Between 120° F and 150° F
  - d. 10° F below the freezing point of Package A
  - e. None of the above
4. Package B shows the sharpest increase in temperature between what two time increments?
  - a. 0 - 30 minutes
  - b. 30 - 60 minutes
  - c. 1 hour - 1 hour 30 minutes
  - d. 1 hour 30 minutes - 2 hours
  - e. None of the above
5. In general, which statement best applies to the test?
  - a. Package A stays colder than Package B after 3 hours
  - b. You can assume that the Freezer packs were set out at room temperature for the duration of the test
  - c. Package A is the better Freezer Pack
  - d. Package A and Package B do not contain the same concentration of coolant
  - e. Not enough information is given to conclude which Freezer Pack is the best

## Marketing and Profitability Activity: 9-12 A CED 3, K-12 MP.1, 3, 4 (among others)

The MIRN (Math I Really Need) Snack Mix Company assigns you to a team whose goal is to oversee the "launch" of the company's newest snack product.

MIRN's new snack product's proposed batch ratios are:

- 1 part Pretzels
- 1 part Cheerios
- ½ part Candy Corn
- 1 part Corn Chex cereal
- 1 part Rice Chex cereal
- ½ part M&Ms



If we were to change the proposed batch ratio, any snack mixture we take to market must contain all of these ingredients. Each ingredient would have a minimum of .5 ounces in the 8 ounce bag while no ingredient could be more than 4 ounces.

1. Taste the product.
2. Brainstorm a name for the new product. \_\_\_\_\_

### Packaging and Product Cost Data:

The product would be sold in 8-ounce packages.

Ingredient costs:	
Pretzels	\$3.99/20 oz.
Cheerios	\$6.49/120 oz.
Candy Corn	\$2.99/20 oz.
Corn Chex Cereal	\$1.99/13 oz.
Rice Chex Cereal	\$1.99/13 oz.
M&Ms	\$8.49/42 oz.

3. Based on the proposed batch ratio, calculate each ingredient's weight in an 8 ounce batch.

Pretzels	_____ oz.
Cheerios	_____ oz.
Candy Corn	_____ oz.
Corn Chex Cereal	_____ oz.
Rice Chex Cereal	_____ oz.
M&Ms	_____ oz.

### Cost Considerations: Cost, Profit Margin, & Selling Price

4. What is the product cost of an 8-ounce package? \_\_\_\_\_
5. What would MIRN charge for an 8-ounce package if they wanted a 20% profit margin (based on product cost)? \_\_\_\_\_
6. What other costs (expenses) are factored into the selling price of this snack product for us to accurately determine our profit margin & or set our price? \_\_\_\_\_
7. What is the least expensive mixture we could produce if we were to alter the proposed batch ratio?
8. Food for thought - Would the formula we find in question 7 be the most profitable for us to bring to market? Why or why not?

**This IS higher level math and could go to even more complex levels if we were to incorporate nutrition labels, profit margins, sales data, etc...**

**More importantly: It is Relevant and Engaging for students. This is "Quadrant D" learning. It is CAREER READY MATH.**



# CTE is Career and Technical Education

## CTE = Higher Graduation Rates

CTE students are more likely to complete high school. This statement is based on countless studies and supporting data including:

The "Silent Epidemic" a nationwide study of high school dropouts funded by the Gates Foundation  
Indiana University Study on High School Student Engagement  
Dropout Calculator from "Big Picture Learning"

## CTE = Increased likelihood of persevering in college and obtaining a degree

Students taking three or more high school CTE courses are far more likely to persevere in college and obtain a degree. Sources include:

National Research Center for Career and Technical Education, University of Louisville  
High Schools That Work, Southern Regional Education Board

## CTE = Career Readiness

Many CTE courses lead to industry credentials while most prepare students for the world of work by providing "real world" examples, problem based learning, and authentic assessment. CTE coursework encourages critical thinking and problem solving while applying core area knowledge in authentic and meaningful ways. A study of pre-employment screening exams for some of the State and nation's largest employers reinforces the need for CTE coursework in our schools.

**However....** Over the past several decades, many States have mandated more core academics. These additional core courses have made no impact on national test scores and student achievement measures. The charts on the back illustrate the impact of more core mandates. In short, more of the same is not working and these mandates get in the way of students taking CTE courses!

Quality CTE coursework is the **solution** to our workforce AND college preparation needs.



In an effort to increase student performance on standardized test scores, many states have mandated more high school Mathematics over the past several decades.

2012 test data shows virtually no change with a national score of 306. It has flat-lined. Math scores have deviated less than two percent from the mean over the past four decades. This is in spite of increased mandates in many States including Illinois.

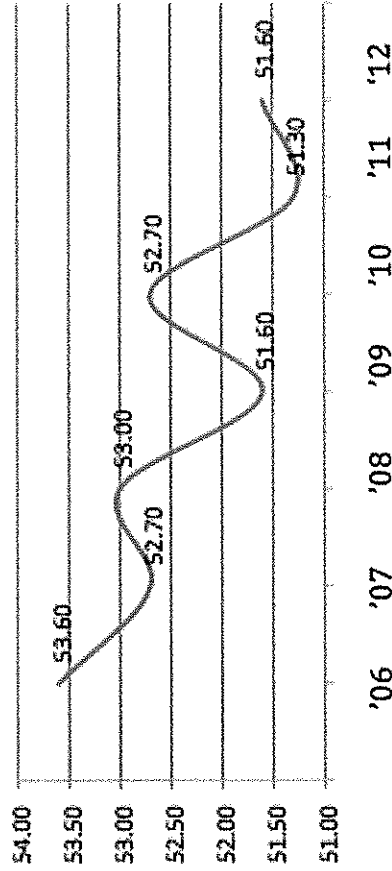
**More of the same does not work and gets in the way of students taking beneficial CTE coursework.** As a result, some States have pulled back on mandated coursework.

Several years ago, Illinois mandated additional core coursework in our high schools. This begs the question:



What impact has additional core coursework had on student achievement in Illinois?

### 2006-2012 Illinois PSAT trend data for 11th grade Math

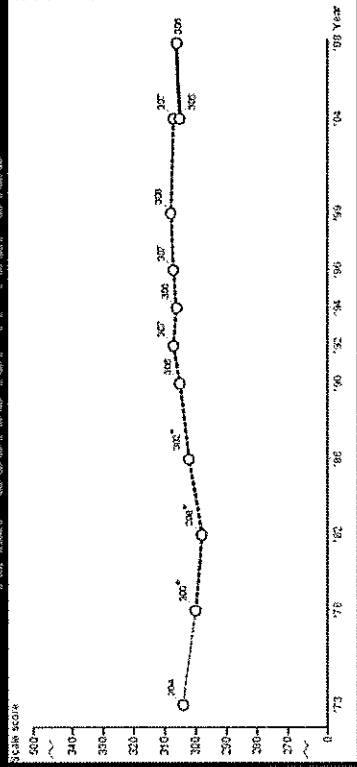


Quality CTE coursework is the **solution** to our workforce AND college preparation needs.

## National Assessment of Educational Progress

### Math needs relevance!

#### NAEP Scores for 17 Year Olds



The class of 2009 was the first class to be required to take three years of high school math. This would indicate that many of the scores of 11<sup>th</sup> graders in 2008 would be students in their third year of math working towards fulfilling the additional graduation requirement. As the chart clearly indicates, additional mandates have no positive impact on standardized test scores.

Overall reading scores show a more significant decline since the advent of an additional Language Arts requirement. Industry exams clearly point to the need for technical reading and the importance of a firm understanding of elementary mathematics. CTE texts contain technical reading and are often the highest grade level text found in our schools. Additionally, they contain industry specific language and applied math preparing our students for the world of work.