



METAL TRADES ASSESSMENT

Math Study Guide

TRADES MATH
1st Compilation 2015-06-18



NORTH ISLAND



COLLEGE

Study Guide *for entry to*
WELDING & METAL FABRICATION

North Island College
2015

1st Compilation June 18th, 2015

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INTRODUCTION:

The Metal Trades Assessment has 4 sections: Applied Math, Applied Geometry, Measurement and Spatial Reasoning. Applicants to the Welding Program must demonstrate understanding of the concepts covered in both General Math and those items in the Geometry section that have a *. Applicants to Metal Fabrication must demonstrate mastery of all sections.

The Metal Trades Assessment allows students to use a scientific calculator. Use of a scientific calculator for any work in the study guide is recommended. In the Metal Trades Assessment most formulas are provided but students are expected to know how to calculate area and perimeter of squares and rectangles. A Formula page is provided at the end of the review pages (page 40).

This package is set up in 4 sections: General Math, Geometry, Measurement and Spatial Reasoning. The General Math and Geometry sections have Pre-assessment, Guided Assessment and Readiness Assessment sub-sections.

In order to do well on the General Math students must know how to do calculations involving decimals, fractions, percentages, ratios and proportions. Students must be able to solve word problems involving these concepts and be able to determine which mathematical operation (+ - x ÷) to apply. In order to do well in Geometry students must know how to solve for unknown angles, calculate area, volume, circumference, arc length etc. Students will be asked to work with conversions between metric and imperial as well in both General Math and Geometry.

Pre-assessment – this section allows you to assess where your skills are currently and what you need to review.

Guided Assessment – this section gives you hints as to what mathematical operations are required to solve the questions. It does not do the math, it just points you in the right direction and helps you to see where you might need review and to what extent.

Readiness Assessment – this section helps you to decide if you are ready to do an assessment for program entry.

In the Measurement and Spatial Reasoning sections sample questions are provided to build familiarity.

Answers for all sections are provided at the end of the package (pg. 41).

LET'S BEGIN



GENERAL MATH





PRE-ASSESSMENT GENERAL MATH

CALCULATORS ALLOWED

CALCULATIONS

All answers for questions involving fractions must be expressed in fractions and reduced to the lowest terms.

Add the following:

$$\begin{array}{r} 1. \quad 45.003 \\ \quad 128.7 \\ \quad \quad 3.417 \\ \hline \quad 499.67 \end{array}$$

$$2. \quad 75.0986 + 1009.3 + 34567.1 =$$

$$3. \quad \frac{2}{7} + \frac{3}{28} + \frac{5}{14} =$$

$$\begin{array}{r} 4. \quad 18 \frac{3}{4} \\ \quad 35 \frac{9}{16} \\ \quad + 22 \frac{7}{8} \\ \hline \end{array}$$

Subtract the following:

$$\begin{array}{r} 5. \quad \$6072.19 \\ \quad - 4943.78 \\ \hline \end{array}$$



6. $\frac{3}{4} - \frac{5}{16} =$

7. $137\frac{2}{3}$
 $-28\frac{7}{8}$

Multiply the following:

8. 147.49
 $\times 75$

9. $\frac{3}{8} \times \frac{21}{24} =$

Divide the following:

10. $486.24 \div 12 =$

11. $70896.8 \div 320.8 =$

12. $\frac{17}{18} \div \frac{5}{9} =$

13. What is 34% of 222?



14. How do you write 63.4% as a decimal?

15. What is 125% of 760?

16. How do you write $\frac{16}{25}$ as a percentage? _____

17. Solve for n $\frac{8}{5} : \frac{n}{30}$ $n =$ _____

18. Solve for n $\frac{3}{4} : \frac{27}{n}$ $n =$ _____

GENERAL MATH WORD PROBLEMS

1. You need to spread grass seed over a yard that measures $11\frac{1}{2}$ meters by 25 meters. The seed supplier that you are using recommends that you use 1 cup per 2.5 square meters. A single bag of seed contains 12 cups. How many bags of seed must you purchase to seed the yard?
2. Your neighbour is building a fence and is constructing his own lattice pattern so he is cutting strips of wood. If he needs strips that are $6\frac{3}{8}$ feet long and the strips are sold in 20 foot lengths, how many lengths will he need to buy if he needs 4 strips per fence panel and he is putting up 12 panels?



3. You have started working as an apprentice automotive mechanic and your employer is paying you \$19.25 per hour. Your regular work day is 7.5 hours and you work Monday through Friday. a) If in the first week you work you work a half hour longer each day and get paid double time for those hours, what will be your salary, before taxes?
b) If at the end of 4 weeks your boss is pleased with your work and gives you a 15% raise, how much will you be making per hour?

a) _____

b) _____

**GENERAL MATH GUIDED ASSESSMENT**

1. What is 67% of 210?
(Hint: remember you can change the % to a decimal and then multiply)
2. Draw 2 parallel lines. *(Hint: do these lines touch?)*
3. Draw 2 perpendicular lines. *(Hint: do these lines touch?)*
4. The convention centre is being renovated. Three large pipes must be moved into the main hall for installation. The first pipe weighs 76.94 kg; the second 82.6 kg and the third 91.731 kg. What is the total weight that must be moved?
(Hint: remember to keep the decimal place constant)



5. The owner of 4 auto body repair shops has ordered large bolts. If he has ordered 2500 bolts how many will each shop get? (*Hint: each shop will get fewer than 2500 bolts, so do not multiply*)

6. $4\frac{2}{3} + 3\frac{3}{4} + 6\frac{5}{6} =$

(*Hint: in order to add fractions you must find a common denominator*)

7. $75\frac{7}{24} - 38\frac{11}{12} =$

(*Hint: See hint for # 6*)

8. A group of 5 employees each contribute 25% of one day's pay for a children's charity. If two employees make \$17.50 an hour, one makes \$19.00 an hour and the two remaining make \$20.20 an hour and all employees work 7 hours, how much did the group contribute to the charity?

(*Hint: #1 you will need to use multiplication and addition to solve this question #2 remember you could change the percentage to a decimal*)



9. A. You and your neighbour are building a new fence between your farms. If the distance between the first post and the last post is 209.25 feet and the fence posts are 9 inches wide each. How many fence posts will you need if the distance between posts is 6 feet?
(Hint: #1 remember to count the first and last posts)

B. If the posts cost \$6.72 each, how much will the posts cost?

10. An apprentice carpenter is told to drill holes $2\frac{1}{2}$ inches apart on a 6 foot long board with each hole to be 2 inches wide and the first hole is inset from the edge by $4\frac{1}{2}$ inches. How many holes will be drilled?

(Hint#1: if the first hole is inset $4\frac{1}{2}$ inches, remember that you no longer have 6 feet of board to work with. Hint #2: A diagram might be useful)

How many holes? _____

11. You find that your time clock gains 2 minutes in 6 hours. How much will it gain in 3 days?
(Hint: this is a proportion questions, the time it gains in 3 days is the unknown, solve for 'n')

12. A category 5 hurricane dropped 12 inches of rain over 48 hours. How much rain is this per hour? Give your answer to 2 decimal places.
(Hint: See # 11)



THE GENERAL MATH READINESS ASSESSMENT STARTS ON PAGE 18

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144



GENERAL MATH READINESS ASSESSMENT

You have had the opportunity to improve your skills. Now see if you are truly ready to do the Program Entry Assessment.

1. Do the indicated math:

a)

$$\begin{array}{r} 1000.002 \\ - 853.621 \\ \hline \end{array}$$

b)

$$\begin{array}{r} 21.376 \\ \times 48.9 \\ \hline \end{array}$$

c)

$$\frac{14}{15} \times \frac{15}{16} =$$

d)

$$35\frac{1}{4} \div 3\frac{1}{2} =$$

2. An owner of 2 tow trucks is stocking up on chain. If chain is \$17.25 for a metre of chain, how much will it cost him to buy 22 metres of chain?

3. Bolts weigh 13.7 kg per bag and nuts weigh 5.3 kg per bag. If the air conditioning service centre has 232.9 kg of bolts and 79.5 kg of nuts in stock, how many bags of each do they have?

a) Bolts _____

b) Nuts _____

4. Fill in the blanks on the pipe measurement chart below:

(The circumference of a circle divided by the diameter = 3.14)

Express all answers as fractions. Round to nearest quarter inch or to 2 decimal places.

Material	Diameter (Outside)	Circumference
Cast Iron	2 1/4 inches	
	4 1/4 inches	
		10 1/4 inches



5. 41% of all nonresidential building starts in 2012 in Courtenay and Campbell River were green, as compared to 2% of all nonresidential building starts in 2005. What is the actual number of green nonresidential buildings for both years if in 2005 50 buildings were constructed and in 2012 78 buildings were constructed?

2005? _____ 2012? _____

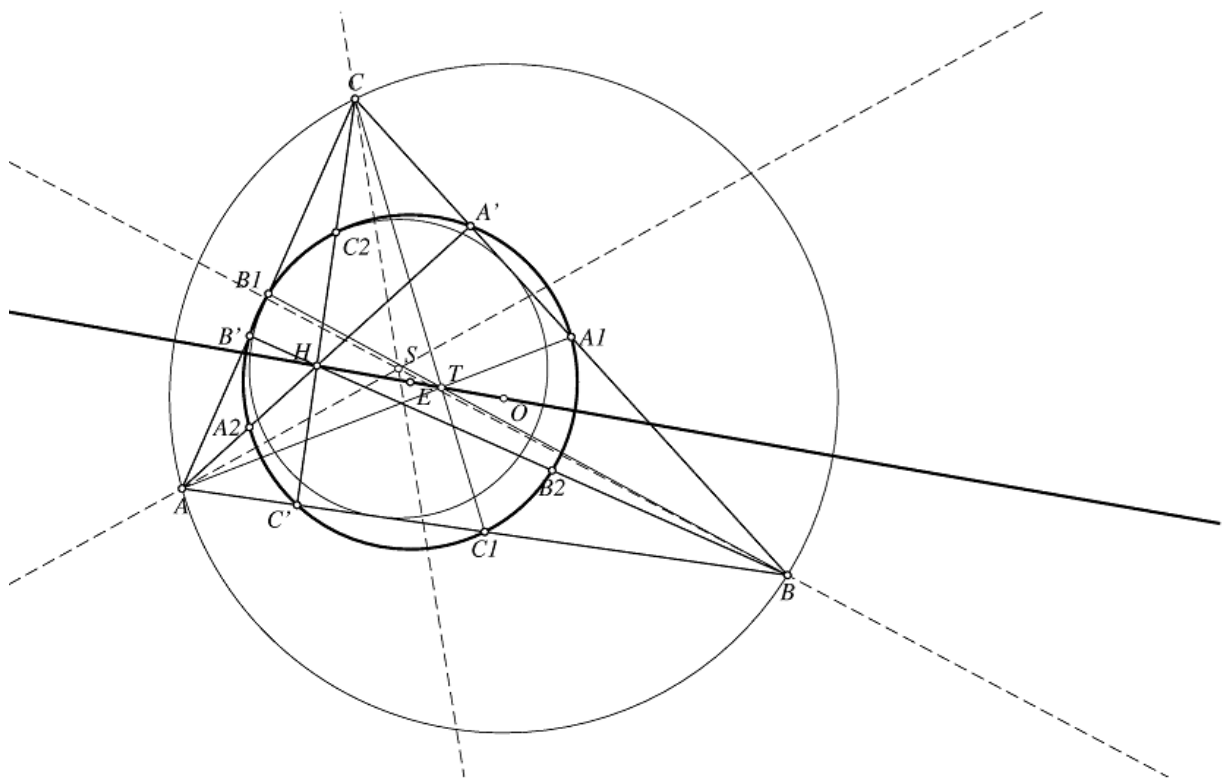
6. Pacific Coast Builders set a goal in 2010 to decrease the amount of construction waste sent to the landfill by 5% each year. In 2010 they recycled or reused 76 Tons and sent 129 Tons of waste to the landfill (63%). Complete the chart below to show how many fewer tons of waste they have sent to the landfill each year.

Year	Total (Tons)	Recycled (Tons)	Landfill (Tons)	% to landfill
2011	231		134	
2012	198	93		
2013	188		89	
2014	156	100		

7. In a delivery of 400 auto parts from a new manufacturer in Oshawa, 14 parts were found to be defective. Based on those numbers how many defective parts should be expected in the next delivery of 1000 parts?



GEOMETRY





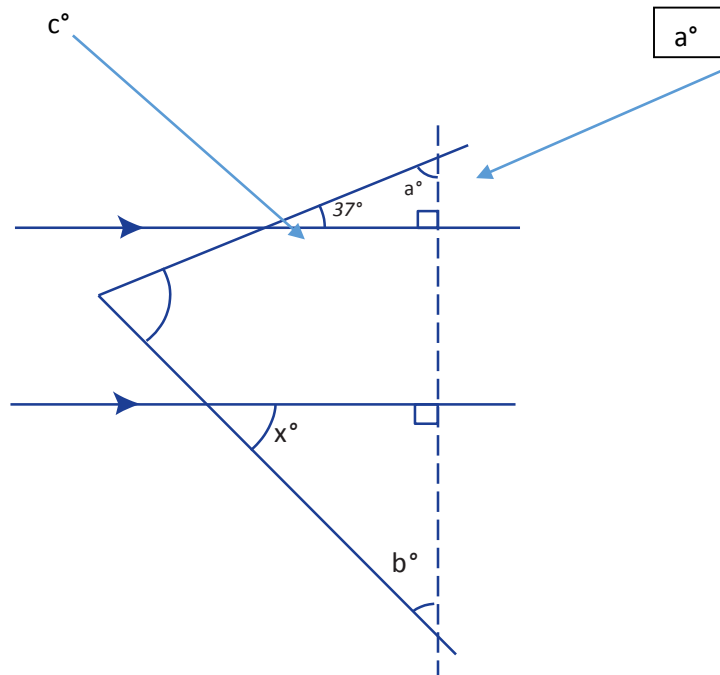
GEOMETRY PRE-ASSESSMENT

Solve for the unknown angles



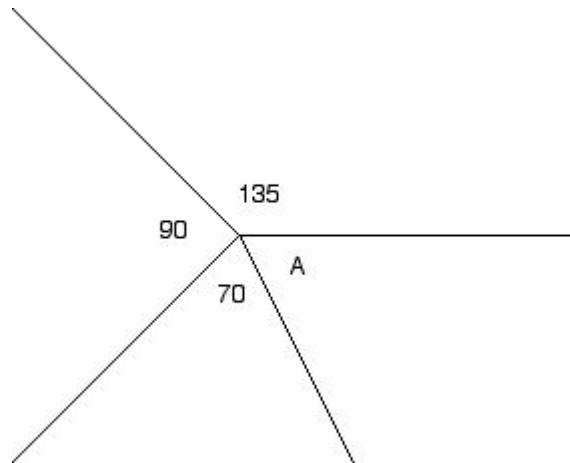
1. *
The tree trunk forms a 90° angle with the ground. The angle where the tip of the tree touches the ground is 33° . What is the size of the angle where the trunk snapped?

2. Solve for angle a° and c° below



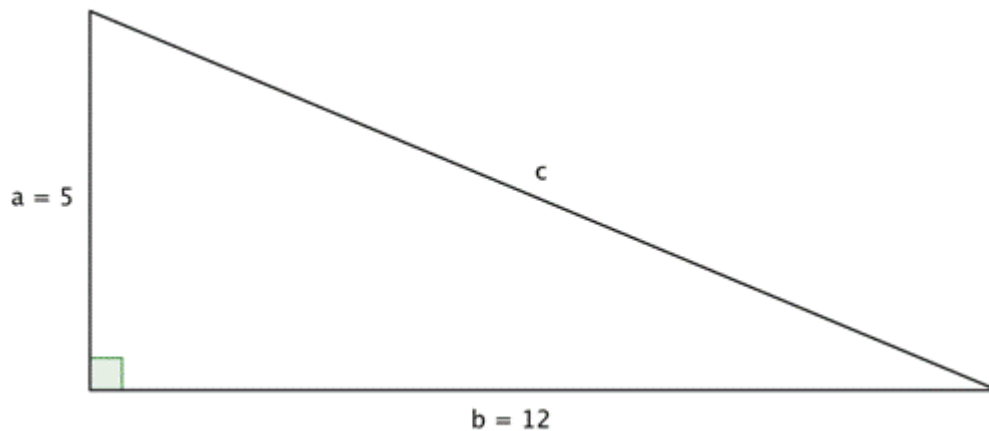
a° _____

c° _____



3. What is the size of angle A? _____

4. The Pythagorean Theorem can be used in right angle triangles to solve for the length of an unknown side. The formula is $a^2 + b^2 = c^2$. Apply that formula to solve for the length of side c in the triangle below.

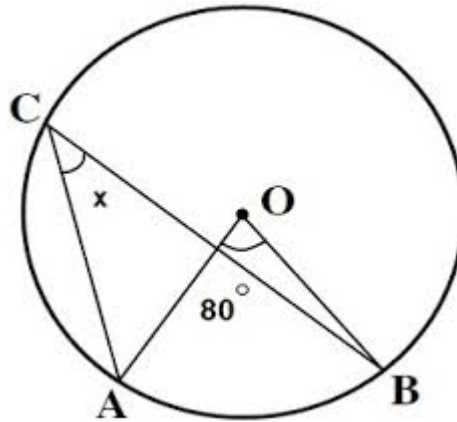




5. The circumference of a circle divided by the diameter is 3.14. Using this information solve the following: GIVE ANSWER TO 2 DECIMAL PLACES
- a) A circle has a diameter of $15\frac{3}{8}$ inches. What is the circumference?
_____ in.
- b) A circle has a circumference of 3 feet $3\frac{1}{2}$ inches. What is the diameter?
_____ in.
6. If the formula for calculating the area of a circle is $r^2 \times 3.14$ (r is radius) calculate the area for the following circles:
- a. Diameter 122.4 mm _____
- b. Diameter $16\frac{1}{2}$ inches _____
- c. Radius 14.831 cm _____



7. Solve for the size of the following: (Angle B is 35° , Angle C is 30° and AO and CB intersect at right angles)

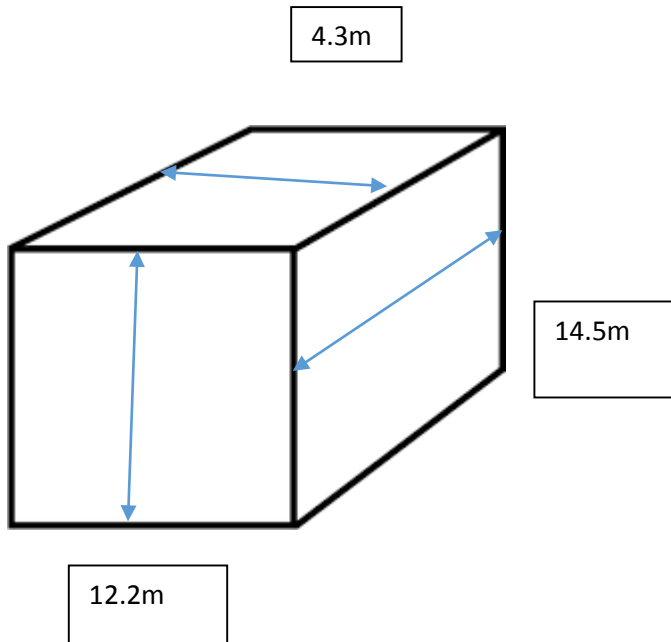


O. _____

A. _____



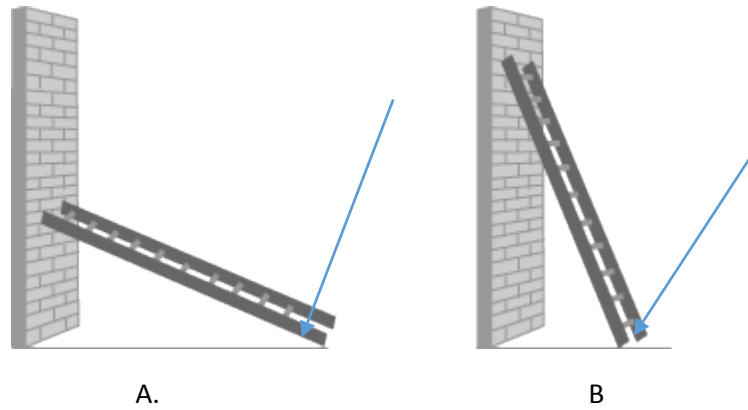
GEOMETRY WORD PROBLEMS



8. *As a contractor you must determine the amount of cement to order to fill a metal form. Based on the measurements above how much space do you need to fill?



9. The foreman has told the carpenter's assistant to place a ladder against the wall so that the indicated angle is 60° . The angle between the wall and the ground is 90° and the angle at the top of figure A is 60° and at the top of Figure B it is 30° . Which ladder is correctly placed? Circle A or B.

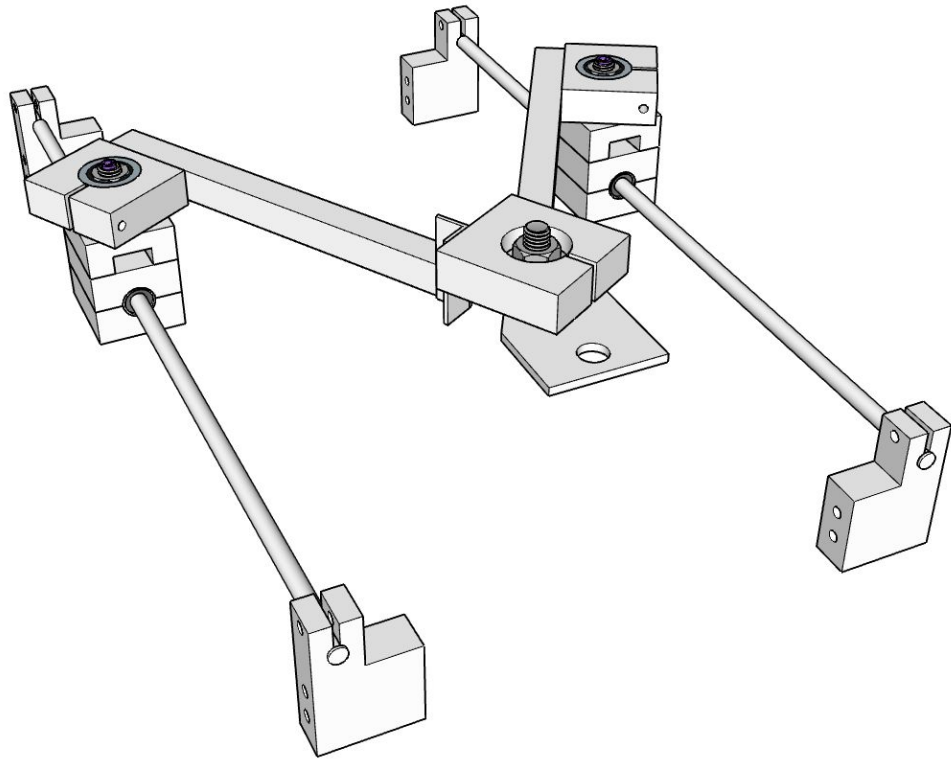


10. The water storage tank is half full. How much more water can it hold?



The formula for the volume of a cylinder is $V = \pi r^2 h$. The height of the tank is 7 feet 3 inches and the diameter is 6 feet. Remember the tank is already half full. Give your answer to 2 decimal places.

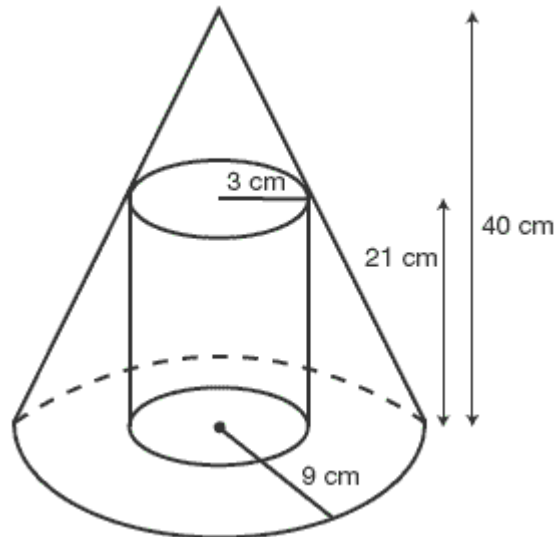
**THE GEOMETRY GUIDED ASSESSMENT
STARTS ON PAGE 28**





GEOMETRY GUIDED ASSESSMENT

1. Examine the cylinder below. What will be the volume of the cylinder? What is the volume of the cone? $\pi = 3.14$



(Hint: The formula for the volume of a cylinder is $V = \pi r^2 h$ and the radius is provided. The formula for the volume of a cone is $1/3$ the volume of the cylinder it is in - so take one third of the volume of the cylinder that would be 40 cm high with a radius of 9 cm)

The cylinder volume is: _____

The cone volume is: _____

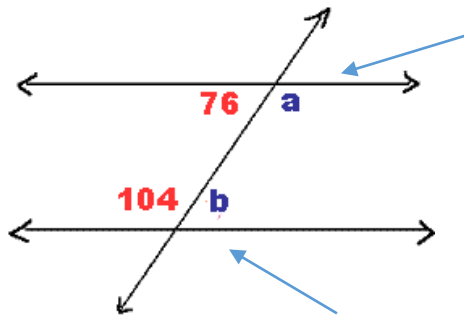


2. *If the work crew at a new job site must build a fence around the site and the site is 750 x 600 metres and the wire fencing is sold in 500 foot rolls, how many rolls of wire fencing must the supervisor purchase to enclose the work site? (There are 3.28 feet in a metre)

_____ rolls of fencing

(Hint: this question is perimeter and not area)

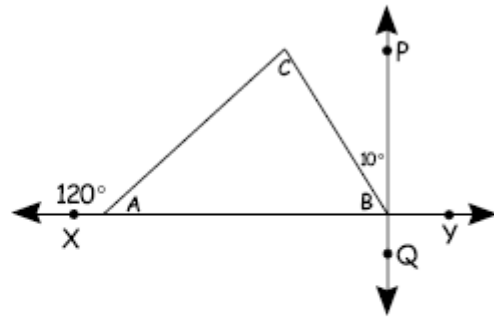
3. Solve for the size of the unknown angles a and b:



(Hint: #1 If the horizontal lines are parallel and, they are; then the opposite interior angles [see arrows] are the same size) (Hint: #2 How many degrees in a straight line?)

4. Consider:

Line PQ is perpendicular to line XY.



- a. How many degrees in angle A? _____
- b. How many degrees in angle B? _____
- c. How many degrees in angle C? _____

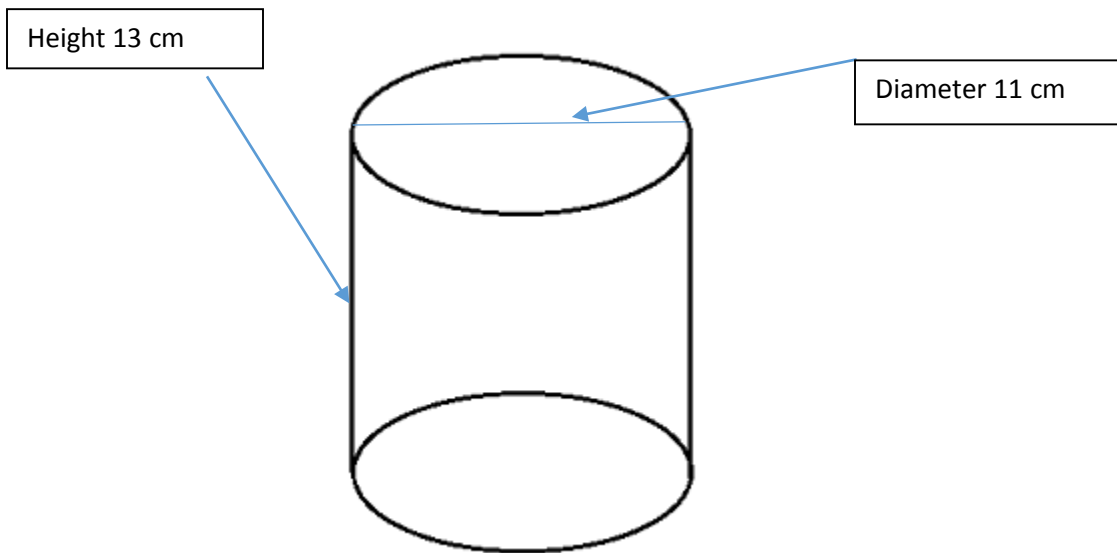
(Hint: Remember how many degrees in a straight line?)



5. The formula for the volume of a cylinder is $V = \pi r^2 h$. What is the volume of this cylinder?

($\pi = 3.14$)

H

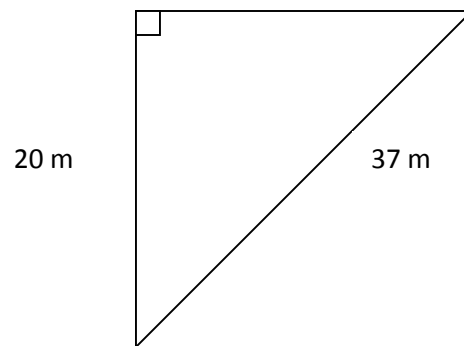


(Hint: What is the relationship between radius and diameter?)

Answer: Volume is: _____



6. *A lot for sale has the shape of a right triangle. The longest side is 37 meters and one of the other sides is 20 meters. How long is the third side? Give your answer to 3 decimal places.



(Hint the side that is 20 m is side a and the side that is 37 m is side c AND $a^2 + b^2 = c^2$)

Answer: _____



THE GEOMETRY READINESS ASSESSMENT

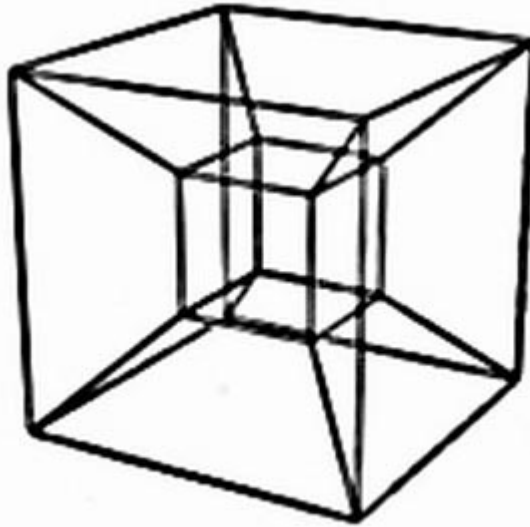
STARTS ON PAGE 36



**GEOMETRY READINESS ASSESSMENT**

Throughout this section: $\pi = 3.14$

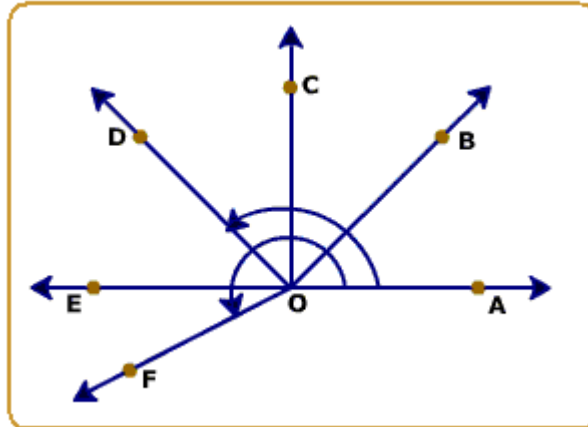
1. *A metal cube is mounted inside a wooden rectangular box. If one side of the cube is 9 cm. What is the volume of the cube? _____



If one side of the rectangle is 8 cm longer than the cube and the second side is 5 cm longer and the height of the box is 13 cm, what is the volume of the box?

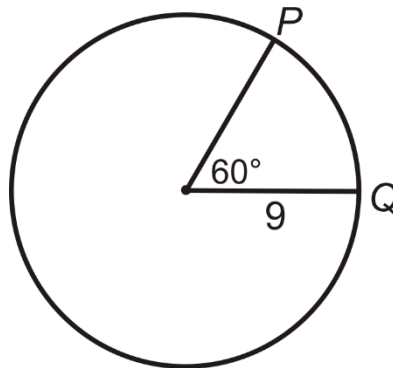


2. Use the information provided to give the size of the requested angles.



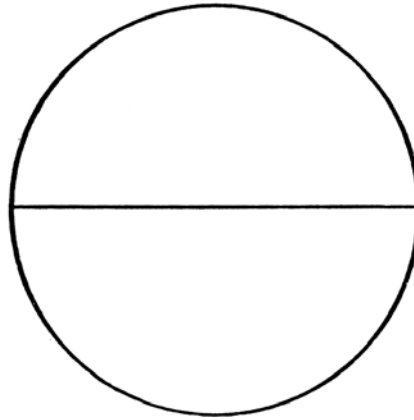
- a) Angle AOF is 147° . How big is angle FOE? _____
 b) Angle COA is a right angle and line B divides that line in half.
 How big is angle BOA? _____
 c) If angle EOD is 32° , how big is angle AOD? _____
 d) How big is angle FOA? _____

3. Determine the arc length PQ. _____
 See Formula Sheet if you do not know how to calculate arc length.





4. The diameter of this circle is 36 feet.
 What is the area of this circle in square inches? _____ (to 2 decimal places)
 What is the circumference of this circle? _____ (to 2 decimal places)



5. Information and tasks appear in Box A. Fill answers to the Tasks in Box B.

BOX A

Shape	Numbers	Task 1	Task 2
Circle #1	Radius 6 cm	Area in cm^2	Area in mm^2
Square	Side 9 inches	Perimeter	Area in ft^2
Rectangular Box	W(13m)xL(11m)xH(7m)	Volume	Area in cm
Circle #2	Diameter 14 feet	Area in in^2	Area in ft^2

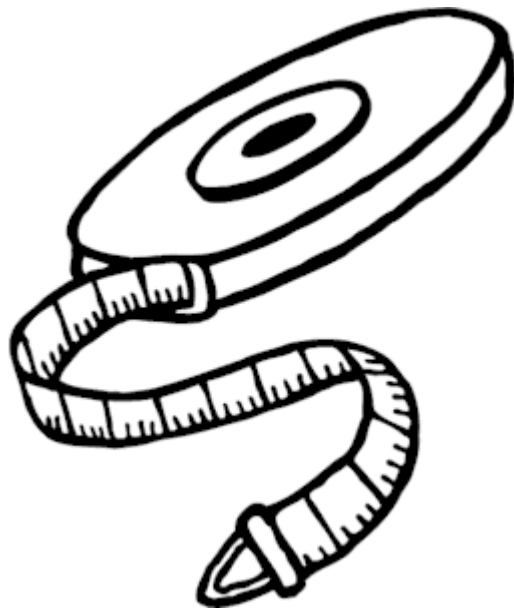
BOX B

Shape	Task 1	Task 2
Circle #1		
Square		
Rectangular Box		
Circle #2		



MEASUREMENT SAMPLE QUESTIONS

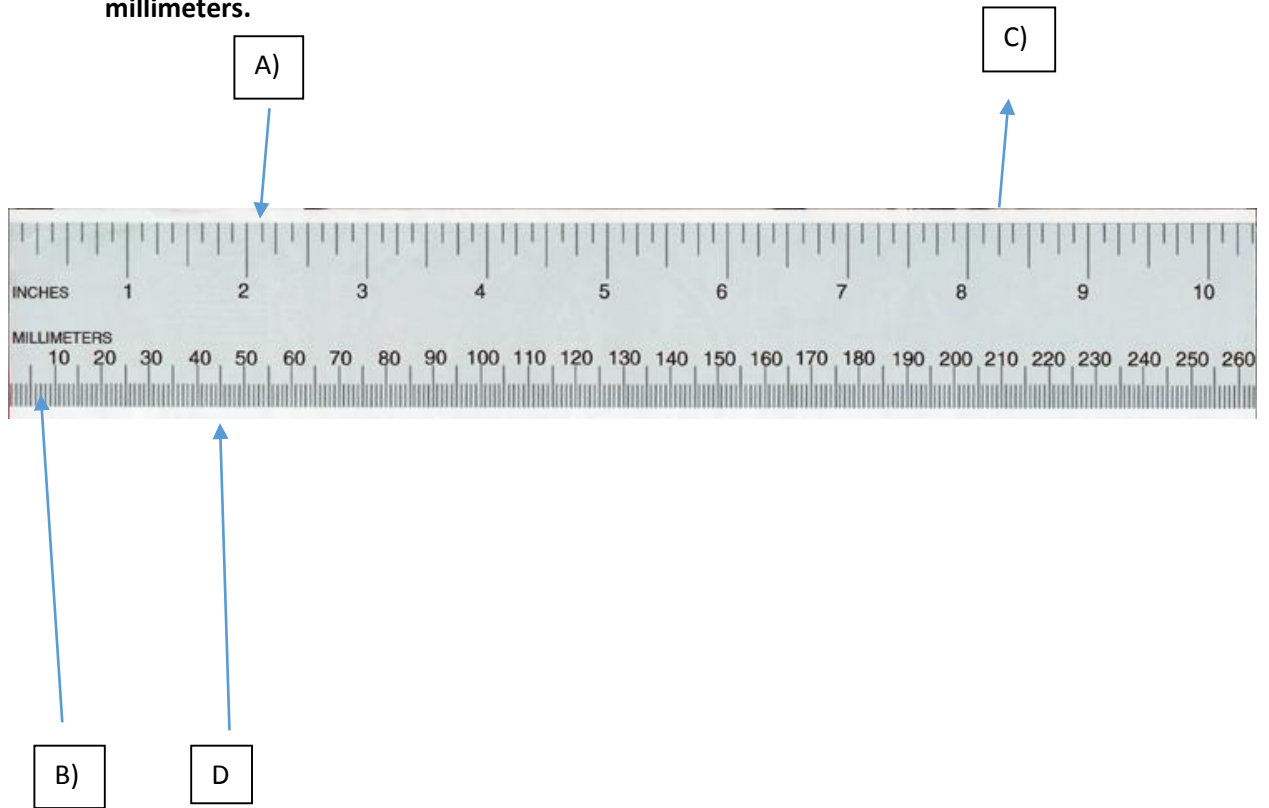
START ON PAGE 40





MEASUREMENT SAMPLE QUESTIONS

1. Write down the measurements indicated by the arrows. Pay careful attention to the system (metric or imperial) of measurement asked for and the value. Indicate inches or millimeters.



A) _____

C) _____

B) _____

D) _____



2. Use the chart to make the necessary conversions.

1 mil	0.001 inch	0.0254 millimeter
1 inch	1,000 mils	2.54 centimeters
12 inches	1 foot	0.3048 meter
3 feet	1 yard	0.9144 meter
5.5 yards or 16.5 feet	1 rod (or pole or perch)	5.029 meters
1 mile	5,280 feet	1.6094 kilometers
40 rods	1 furlong	201.168 meters
8 furlongs	1 mile	1.6094 kilometers
3 miles	1 league	4.83 kilometers
	1 millimeter	0.03937 inch
10 millimeters	1 centimeter	0.3937 inch
10 centimeters	1 decimeter	3.937 inches
10 decimeters	1 meter	39.37 inches or 3.2808 feet
10 meters	1 decameter	393.7 inches or 32.8083 feet
10 decameters	1 hectometer	328.083 feet
10 hectometers	1 kilometer	0.621 mile or 3,280.83 feet
10 kilometers	1 myriameter	6.21 miles

- a) 9 inches = _____ cm
- b) 6 feet = _____ meters
- c) 25 cm = _____ mm
- d) 7.62 cm = _____ inches
- e) 230 cm = _____ meters



3. Use the chart below to make the necessary conversions: Answers to 2 decimal points

Weight

1 imperial ounce	= 28 grams
1 gram (gm)	= .035 imperial ounce
16 oz.	= 1 lb.
1 imperial pound	= 454 grams
1 kilogram	= 2.2 Imperial pounds

a) 14 oz = _____ gm

b) 8 lb = _____ kg

c) 17.5 lb = _____ oz

d) 75 gm = _____ oz



SPATIAL REASONING SAMPLE QUESTIONS

START ON PAGE 44



A

B

C

D

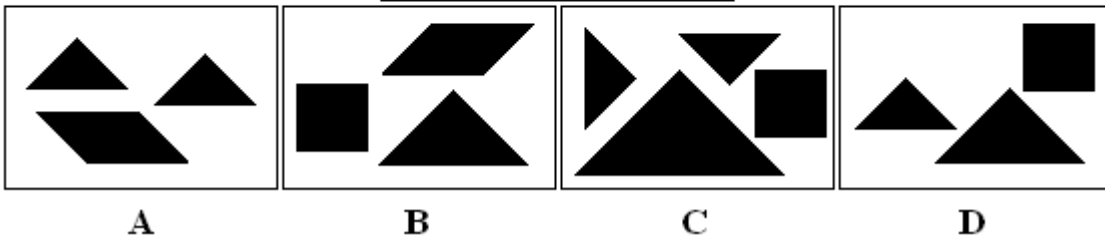
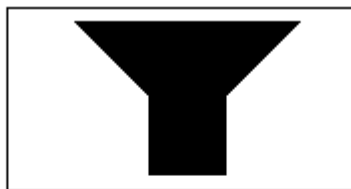
E



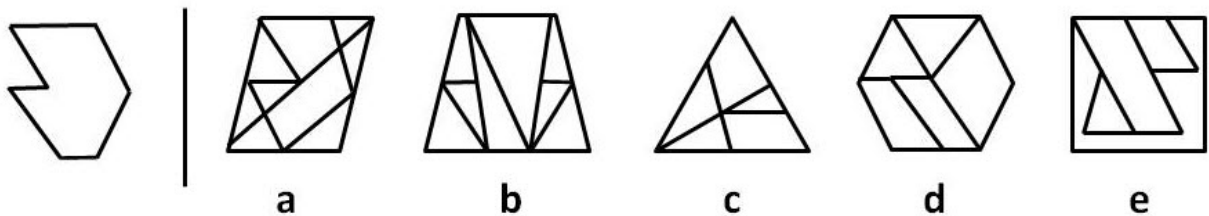
SPATIAL REASONING SAMPLE QUESTIONS

Spatial reasoning involves visualising and then manipulating different complex shapes and patterns. Spatial reasoning is a key ability in many trades. Below are some sample Spatial Reasoning questions. Answers are at the end.

BOX X



1. Select which of the lower boxes displays the shapes needed to assemble the shape in BOX X:
 X: _____



2. Find the figure on the left imbedded in one of the five on the right. _____



Group 1					Group 2				
1	2	3	4	5	A	B	C	D	E
6	7	8	9	10	F	G	H	I	J
11	12	13	14	15	K	L	M	N	O
16	17	18	19	20	P	Q	R	S	T
21	22	23	24	25	U	V	W	X	Y

3. Match the numbered figures in Group 1 to identical figures in Group 2 by writing the letter:

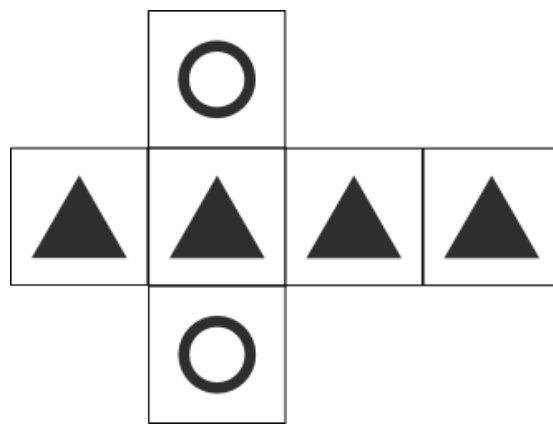
1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____

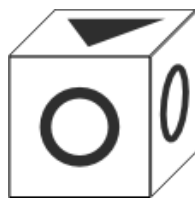
13. _____ 14. _____ 15. _____ 16. _____ 17. _____ 18. _____

19. _____ 20. _____ 21. _____ 22. _____ 23. _____ 24. _____

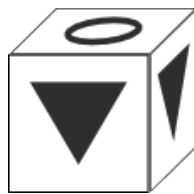
25. _____



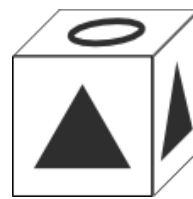
b) Which of these cubes represents the layout above?



(a)



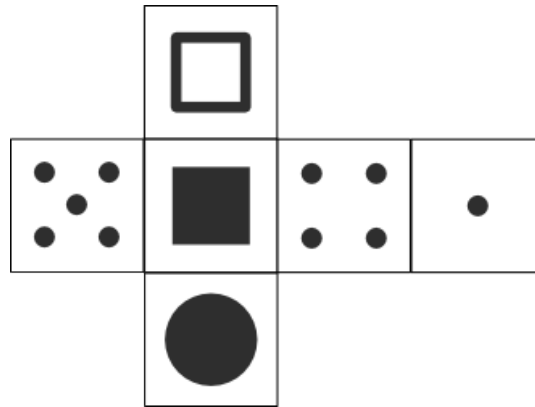
(b)



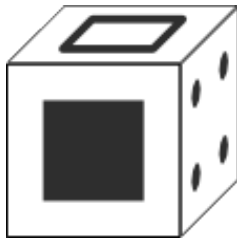
(c)



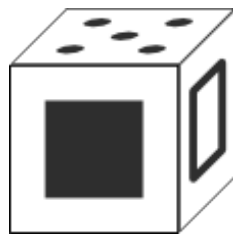
(d)



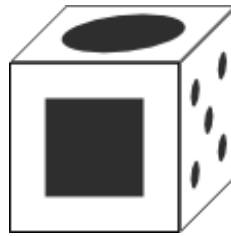
c) Which of these cubes represents the layout above?



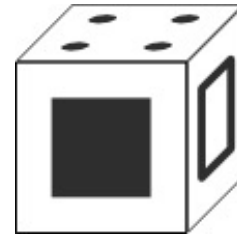
(a)



(b)



(c)



(d)



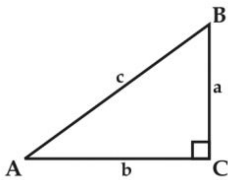
FORMULA SHEET

AREA:

Of a circle: $A = \pi r^2$

Of a triangle: $\frac{\text{height} \times \text{base}}{2}$

Of a right angle triangle: $\frac{a \times b}{2}$



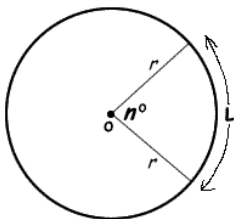
CIRCUMFERENCE OF A CIRCLE

Circumference = diameter $\times \pi$

ARC LENGTH

Length of an Arc Formula

$$\text{Length} = \frac{n^\circ}{360^\circ} \times 2\pi r$$



n° is the size of the angle and r is the length of the radius

VOLUME

Volume of a cylinder: $V = \pi r^2 h$

Volume of rectangle: $V = l \times w \times h$

The Pythagorean Theorem: $a^2 + b^2 = c^2$

ANSWER KEY

**PRE-ASSESSMENT ANSWER KEY: GENERAL MATH**

CALCULATIONS

1. 676.79

8. 11061.75

2. 35651.4986

9. $\frac{21}{64}$

3. $\frac{3}{4}$

10. 40.52

4. $77\frac{3}{16}$

11. 221

5. 1128.41

12. $1\frac{7}{10}$

6. $\frac{7}{16}$

7. $108\frac{19}{24}$

13. 75.48

14. 0.634

15. 950

16. 64%

17. 48

18. 36

WORD PROBLEMS

1. $10\left(9\frac{7}{12}\right)$ or 9.58 is wrong answer must be rounded to 10 as you cannot buy part of a bag)

2. He will need to buy 16 of the 20 foot lengths.

3. Weekly salary will be \$818.13. With the raise the hourly rate will now be \$22.14 per hour.

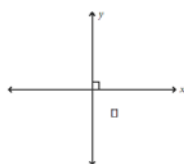


GUIDED ASSESSMENT ANSWER KEY: GENERAL MATH

1. 140.7



2.



3.

4. 251.271

5. 625

6. $15\frac{1}{4}$ 7. $36\frac{3}{8}$

8. \$165.21

9. A. 33 B. \$221.75

10. 15

11. 24 minutes

12. 0.25 inches



READINESS ASSESSMENT ANSWER KEY: GENERAL MATH

1.

a) 146.381

b) 1045.2864

c) $\frac{7}{8}$

d) $10 \frac{1}{14}$

2. \$379.50

3. a) 17

b) 15

4.

Material	Diameter (Outside)	Circumference
Cast Iron	2 1/4 inches	7 inches (7.07)
	4 1/4 inches	13 1/4 inches (13.35)
	3 1/4 inches (3.26)	10 1/4 inches

5. 2005: 1

2012: 32

6.

Year	Total (Tons)	Recycled (Tons)	Landfill (Tons)	% to landfill
2011	231	97	134	58
2012	198	93	105	53
2013	188	100	88	47
2014	156	100	56	36

7. 35 parts will be defective

8. 60 grams



9. 119

PRE-ASSESSMENT ANSWER KEY: GEOMETRY

1. 57°
2. a - 53° c - 143°
3. 65°
4. 13
5. a) 48.28 inches
b) 10 feet 4 inches
6. a) 1176.682 mm^2 b) 213.716 in^2 c) 690.67 cm^2
7. O = 55°
A = 60°
8. 760.67 m^3
9. B
10. 102.44 ft^3

**GUIDED ASSESSMENT ANSWER KEY: GEOMETRY**

1. Cylinder: 593.46 cm^3 Cone: 3391.2 cm^3
2. 18
3. a) 104 b) 76
4. A 60° B 80° C) 40°
5. 1234.805 cm^3
6. 31.129 m

READINESS ASSESSMENT ANSWER KEY: GEOMETRY

1. Volume of the cube – 729 cm^3 Volume of the box – 3094 cm^3
2. a) 33° b) 45° c) 148° d) 213°
3. 9.42
4. Area 146499.84 in^2 circumference 113.04 feet

Shape	Task 1	Task 2
Circle #1	113.04 cm^2	1130.4 mm^2
Square	36 inches	$.5625 \text{ ft}^2$
Rectangular Box	1001 m^3	14300 cm^2
Circle #2	22155.84 in^2	153.86 ft^2



MEASUREMENT ANSWER KEY

1. A) $2\frac{1}{8}$ inches B) 7 or 8 mm C) $8\frac{1}{4}$ inches D) 45 mm
 2. a) 22.86 cm b) 1.8288 m c) 250 mm d) 3 inches e) 2.3 m

4. 14 oz = 392 gm
 8 lb = 3.64 kg
 17.5 lb = 280 oz
 4 m = 2.68 oz

4.

3. 14 oz = 392 gm

$$8 \text{ lb} = 3.64 \text{ kg}$$

$$17.5 \text{ lb} = 280 \text{ oz}$$

$$75 \text{ gm} = 2.68 \text{ oz}$$

SPATIAL REASONING ANSWER KEY

1. b
 2. d
 3. 1 X 2P 3M 4V 5G 6A 7D 8T 9C 10B
 11W 12E 13U 14Y 15F 16S 17H 18K 19J 20L
 21O 22N 23Q 24R 25I
 4. (c)
 5. (a)