# Grade 9 Study Guide

Strand: Number

## General Outcomes: Develop number sense.

Specific Outcomes:

1. **Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by:**
   - **Representing repeated multiplication, using powers**
   - **Using patterns to show that a power with an exponent of zero is equal to one**
   - **Solving problems involving powers.**
- Demonstrate the difference between the exponent and the base by building models of a given power, such as 2^3 and 3^2.
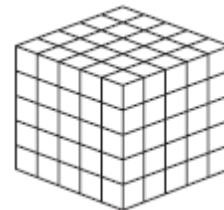
Q1) Find the missing values for the exponential representation of the following models:

2^a b^2 c^d

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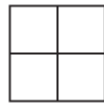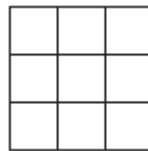
    a   b   c   d

- Explain, using repeated multiplication, the difference between two given powers in which the exponent and base are interchanged; e.g. 10^3 and 3^{10}.

Q2) Mary and John were rolling 2 dice to make powers. When a 3 and 5 showed Mary used the 3 as a base and John used the 5. The student with the larger number is I because her II is bigger:

	I	II
A	**Mary**	Base
B	**Mary**	Exponent
C	John	Base
D	John	Exponent

- Express a given power as a repeated multiplication.
- Express a given repeated multiplication as a power.

Q3) Complete the following table:

Power	Base	Exponent	Repeated Multiplication	Standard Form
6^1	6			
			$9 \times 9 \times 9 \times 9 \times 9 \times 9$	
2^2		2		
			$(-11) \times (-11) \times (-11) \times (-11)$	
			$-8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$	
$(-5)^4$		4		625
-3^7		7		

- Explain the role of parentheses in powers by evaluating a given set of powers; e.g. $(-2)^4$, (-2^4) and -2^4.

Q4) In the following solution, 3 mistakes were made in total. State the error made for each and solve properly

Q5)

The following expressions are examples of powers.

$(2)^{-2}$ $-(2)^2$ $(-2)^2$ $-(2)^{-2}$

1   2   3   4

Listed in order of **increasing** value, the expressions numbered above
are _____, _____, _____, and _____.

- Demonstrate, using patterns, that a^0 is equal to 1 for a given value of a ($a \neq 0$).

Q6) Explain why (C)$^0 = 1$

- Evaluate powers with integral bases (excluding base 0) and whole number exponents.

Q7)   **a.** $(6^2 + 7^2) - (8^4 + 2^4)^0$ **b.** $\dfrac{8^4}{(2^6 \div 4^2)}$

2. **Demonstrate an understanding of operations on powers with integral bases (excluding base 9) and whole number exponents:**
   a. $(a^m)(a^n) = a^{m+n}$
   b. $a^m \div a^n = a^{m-n}$, m>n
   c. $(a^m)^n = a^{mn}$
   d. $(ab)^m = a^m b^m$
   e. $(a/b)^n = a^n/b^n$, b≠0

- Explain, using examples, the exponent laws of powers with integral bases (excluding base 0) and whole number exponents.

Q8)

$$(3^3)^4 = (3^3) \cdot (3^3) \cdot (3^3) \cdot (3^3)$$
$$= (3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3)$$
$$= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$
$$= 3^{12}$$

The Exponent Law represented by the above example is:

a. $a^m \times a^n = a^{m+n}$ c. $(a^m)^n = a^{m \times n}$
b. $a^m \div a^n = a^{m-n}$ d. $(a \times b)^m = a^m \times a^n$

Q9)

$$3^3 \text{ x } 3^4 = (3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3)$$
$$= 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$
$$= 3^7$$

The Exponent Law represented by the above example is:

a. $a^m \times a^n = a^{m+n}$ c. $(a^m)^n = a^{m \times n}$
b. $a^m \div a^n = a^{m-n}$ d. $(a \times b)^m = a^m \times a^n$

Q10)

$$\frac{3^8}{3^4} = \frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3 \cdot 3}$$
$$= 3 \cdot 3 \cdot 3 \cdot 3$$
$$= 3^4$$

The Exponent Law represented by the above example is:

a. $a^m \div a^n = a^{m-n}$ c. $(a \times b)^m = a^m \times a^n$
b. $(a^m)^n = a^{m \times n}$ d. $(a \div b)^m = a^m \div b^m$

Q11)

$$(3 \cdot 5)^2 = (15)^2 \qquad (3 \cdot 5)^2 = 3^2 \cdot 5^2$$
$$= 225$$
$$= 225$$

The Exponent Law represented by the above example is:

a. $a^m \times a^n = a^{m+n}$ c. $(a^m)^n = a^{m \times n}$

b. $a^m \div a^n = a^{m-n}$ d. $(a \times b)^m = a^m \times a^n$

Q12)

$$\left(\frac{2}{3}\right)^2 = \frac{2^2}{3^2} \qquad \left(\frac{2}{3}\right)^2 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$$
$$= \frac{4}{9} \qquad\qquad\qquad = \frac{4}{9}$$

The Exponent Law represented by the above example is:

a. $a^m \div a^n = a^{m-n}$ c. $= a^m \times a^n$

b. $(a^m)^n = a^{m \times n}$ d. $(a \div b)^m = a^m \div b^m$

- Evaluate a given expression by applying the exponent laws.

Q13)   If $\dfrac{(n^3)^4}{(n^6)(n^2)} = 4\ 096$, then n equals _____.

- Determine the sum of two given powers, e.g., $5^2 + 5^3$, and record the process.

Q14) Evaluate:

     a. $8^2 + 12^3$
     b. $(-9)^4 + (-9^4)$
     c. $8^2 + 12^3$

Q15) Evaluate $a^2 + (b - c)^3 + 2$, where $a=-1$, $b=3$, and $c=4$

     a. 7   c. 4
     b. 0   d. 2

- Determine the difference of two given powers, e.g., $4^3 - 4^2$, and record the process.

Q16) Evaluate:

     a. $6^3 - 6^2$

     b. $(-3)^6 - (-3)^{11}$

     c. $9^2 - 4^9$

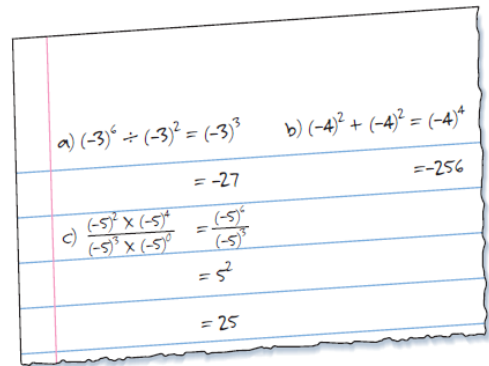- Identify the error(s) in a given simplification of an expression involving powers.

Q17) Which of the following contains an error?

     a. $5^3 \times 5^5 = 5^8$ c. $(4^3)^3 = 4^9$

     b. $3^5 \times 3^5 = 3^{25}$ d. $-(3 \times 4)^2 = -144$

Q18) The choice below that does NOT contain an error is

     a. $\left(\frac{2}{3}\right)^2 = \frac{4}{6}$ c. $\left(\frac{2}{5}\right)^8 = 2^8 \div 2^5$

     b. $[(-5)^3]^0 = (-5)^3$ d. $2^3 \div 5^2 = 10^5$

Q19) State the error for each and solve properly:

  a) $(-3)^6 \div (-3)^2 = (-3)^3$ b) $(-4)^2 + (-4)^2 = (-4)^4$

             $= -27$ $= -256$

  c) $\dfrac{(-5)^2 \times (-5)^4}{(-5)^3 \times (-5)^0} = \dfrac{(-5)^6}{(-5)^3}$

              $= 5^2$

              $= 25$

Q20)

$$\frac{8^4}{(2^8 \div 4^2)}$$

Simplify the above expression to the form a^b where a is the lowest possible base *(write a in the first column and b in the second column)*

Q21)

$$\frac{(2^3 \times 2^4)^2}{(2^2 \times 4^3)}$$

Which of the following powers is equivalent to the expression above?

     A. 2^6

     B. 2^9

     C. 4^{16}

     D. 4^{18}

Q22) Simplify $\dfrac{(-A)^3 \times (-A)^{11}}{(-A)^5 \times (-A)^2}$

- a. A^7
- b. A^{-7}
- c. A^{-8}
- d. $-A^7$

Q23) What is the value of x in the equation $(2a^{-3})(6a^x) = 12a^{15}$?

- a. -18
- b. -12
- c. 12
- d. 18

3. **Demonstrate an understanding of rational numbers by:**
    a. **Comparing and ordering rational numbers**
    b. **Solving problems that involve arithmetic operations on rational numbers.**
- Order a given set of rational numbers in fraction and decimal form by placing them on a number line; e.g. 3/5, -0.666 …, 0.5, -5/8, 3/2.

Q24)

The value indicated by the arrow on the number line above is

- a. -0.5
- b. 1.0×10^{-1}
- c. 0.5
- d. $\dfrac{1}{2}$

Q25)
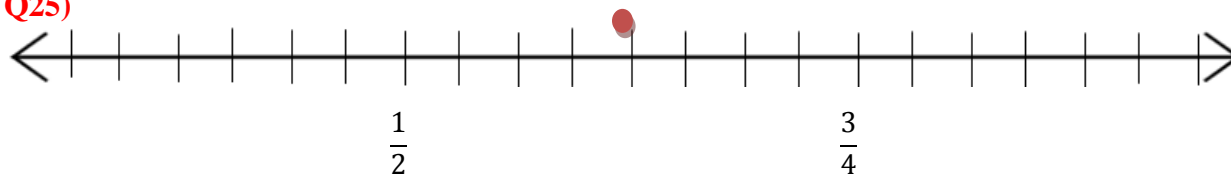
The point indicated on the number line above represents the following rational number:

- a. $\dfrac{4}{2}$
- b. $\dfrac{4}{8}$
- c. $\dfrac{5}{8}$
- d. $\dfrac{1}{4}$

Q26)

$$\{-1.76, 4.3, 0.6, -0.75\}$$

Using the set of numbers of above, The product of the 2 smallest numbers is I and it is between II .

	I	II
A	-0.45	0.6 and -0.75
B	0.45	0.6 and -0.75
C	1.32	-1.76 and 0.6
D	1.32	0.6 and 4.3

- Solve a given problem involving operations on rational numbers in fraction or decimal form.

Q27)

Two friends spent a total of $3\frac{1}{2}$ hours at various places in a mall as shown below.

Food court	25% of the time
Movie theatre	43% of the time
Shops	29% of the time
Other	3% of the time

How many minutes did they spend in the food court?

A. 11.4 min
B. 28.5 min
C. 52.5 min
D. 81.3 min

Q28)

You invested $100 of your allowance for a year. Some months you lost money, and some months you earned money. The following table shows the percentages that your allowance lost or earned.

JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
−2%	−1%	3%	2%	0%	4%	2%	−2%	0%	4%	4%	3%

After one year, how much money will you have **in total**?

a. $18
b. $118

c. $27
d. $127

Q29)

Jeff is counting his small change and finds that he has collected $44.50. He has one-seventh as many quarters as dimes, 0.3 times as many loonies as dimes, and one-tenth as many toonies as dimes.

What is the total value of the loonies in his collection?

a. $14.00

b. $21.00

c. $35.00

d. $70.00

4. **Explain and apply the order or operations, including exponents, with and without technology.**
- Solve a given problem by applying the order of operations without the use of technology.

Q30) Multiplying a number by $\frac{1}{2}$ and then dividing the result by $\frac{3}{4}$ is equivalent to performing which of the following operations on the number?

a. Dividing by $\frac{3}{8}$

b. Dividing by $\frac{2}{3}$

c. Multiplying by $\frac{3}{8}$

d. Multiplying by $\frac{2}{3}$

Q31) If $x = \frac{2}{3}$ and $y = -\frac{1}{3}$ then $x^2 + y \div 4$ has the value of

a. $\frac{1}{36}$

b. $-\frac{1}{36}$

c. $\frac{13}{36}$

d. $-\frac{13}{36}$

Q32) For the following, state which operation you would do first. Then evaluate:

a. $1\frac{1}{3} - \frac{2}{3} + \left(\frac{1}{2}\right)^2$

b. $1\frac{1}{3} \div \left[-\frac{2}{3} + \frac{1}{5}\right]$

c. $\left(-\frac{2}{5}\right)^3 \times \frac{5}{4} \div \sqrt{\frac{4}{144}}$

Q33) For the following, state which operation you would do first, then evaluate:

a. $\left(-3\frac{2}{5}\right) \times \left(-1\frac{5}{6}\right) \div \frac{3}{10}$

b. $\left(-1\frac{4}{5}\right)^3 \div \left[\frac{1}{2} + \right.$
   $-16 - 16 \times 14$

c. $\left(-\frac{4}{5}\right)^2 \div \left[\frac{1}{3} - \sqrt{\frac{121}{81}}\right]$

d. $\frac{\frac{1}{2} + \frac{1}{3}}{\frac{1}{4}}$

Q34) The result of $\frac{6}{5} \times \left(-\frac{2}{3} + \frac{7}{3}\right)^2 - \frac{7}{12}$ is found to be $\frac{a}{4}$. The value of a is:

a. 8

b. 9

c. 10

d. 11

Q35)

Jennifer had the following question on her math homework:

Add brackets to the equation $\quad 3\frac{1}{2} + 3 \div 0.75 + (-8.75) = 3.125 \quad$ to make it true

Which of the following shows the correct placement of brackets for a true statement?

a. $3\frac{1}{2} + (3 \div 0.75) + (-8.75) = 3.125$

b. $\left(3\frac{1}{2} + 3\right) \div 0.75 + (-8.75) = 3.125$

c. $3\frac{1}{2} + 3 \div [0.75 + (-8.75)] = 3.125$

d. *All of the above*

- Identify the error in applying the order of operations in a given incorrect solution.

Q36) Identify the error:

a.
$$(-8.2)^2 \div (-0.3) - 2.9 \times (-5.7)$$
$$= 67.24 \div (-0.3) - 2.9 \times (-5.7)$$
$$= 67.24 \div (-0.3) - 16.53$$
$$= 67.24 \div (-16.83)$$
$$\doteq 4.00$$

b.
a) $(-3.7) \times (-2.8 + 1.5) - 4.8 \div (-1.2)$
$$= (-3.7) \times (1.3) - 4.8 \div (-1.2)$$
$$= -4.81 - 4.8 \div (-1.2)$$
$$= -9.61 \div (-1.2)$$
$$= 8.008\overline{3}$$

c.

b)
$$-\frac{3}{8} - \frac{4}{5} \times \frac{3}{10} \div \left(-\frac{4}{5}\right)$$
$$= -\frac{15}{40} - \frac{32}{40} \times \frac{3}{10} \div \left(-\frac{4}{5}\right)$$
$$= -\frac{47}{40} \times \frac{3}{10} \div \left(-\frac{4}{5}\right)$$
$$= -\frac{141}{400} \div \left(-\frac{4}{5}\right)$$
$$= -\frac{141}{400} \times \left(-\frac{5}{4}\right)$$
$$= \frac{(-141) \times (-5)}{400 \times 4}$$
$$= \frac{705}{1600}$$

5. **Determine the square root of positive rational numbers that are perfect squares. (students should be aware of the existence of positive and negative square roots; however, at this grade, they should only work with the principal, positive square root.)**
- Determine whether or not a given rational number is square number, and explain the reasoning.

Q37)

Which decimals and fractions are perfect squares? Explain your reasoning.

a) 0.12   b) 0.81   c) 0.25

d) 1.69   e) $\dfrac{9}{12}$ f) $\dfrac{36}{81}$

g) $\dfrac{81}{49}$ h) $\dfrac{75}{27}$ i) 0.081

j) $\dfrac{25}{10}$ k) 2.5   l) $\dfrac{8}{50}$

Q38)   Which letter on the number line below
corresponds to each square root?
Justify your answers.

i) $\sqrt{12.25}$ ii) $\sqrt{\dfrac{121}{25}}$ iii) $\sqrt{16.81}$

iv) $\sqrt{\dfrac{81}{100}}$ v) $\sqrt{0.09}$ vi) $\sqrt{\dfrac{841}{25}}$
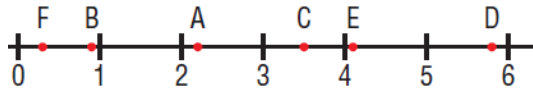
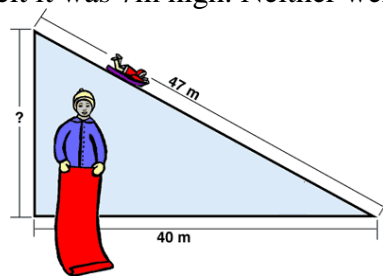**Q39)** The fraction below that is a perfect square is (remember about simplifying!):

a. $\dfrac{8}{18}$ b. $\dfrac{16}{5}$ c. $\dfrac{2}{9}$ d. $\dfrac{9}{12}$

Q40) Jason and Brenna visit Machine Gun hill on a regular basis to go tobogganing.

Jason Figured the hill was about 62m high. Brenda felt it was 7m high. Neither were correct.
a) What mistake did Jason make?
b) What mistake did Brenda make?
c) How high is the hill actually?

Q41) What is x if $x^2 = 36$?

a. 6 only   c. 18 only
b. 6 or -6   d. 18 or -18

Q42) Correct to two decimal places, the area of a square
trampoline that has a side length of 2.6 m is _____ m^2.
(Report your answer to this problem correctly rounded to two
decimal places, without including the unit).
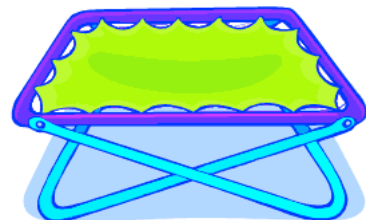
Q43) Tracy was working with the above model to help her understand square roots of rational numbers.

The model was most likely helping her to understand a square with an area of:

a. 1.50 units

b. 2.25 units

c. 3.00 units

d. 22.5 units

$\frac{15}{10}$ units
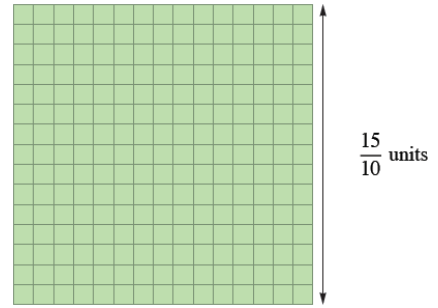
6. **Determine an approximate square root of positive rational numbers that are non-perfect squares.**
   - Estimate the square root of a given rational number that is not a perfect square, using the roots of perfect squares as benchmarks.

Q44) Daniel was calculating $\sqrt{114.5}$. In order to make an estimate he looked at the two **closest perfect** squares on either side of $\sqrt{114.5}$.

Q45) The sum of the <u>square roots</u> of those <u>two perfect squares</u> is

  a. 10.7   b. 15.8   c. 21.0   d. 221.0

   - Determine an approximate square root of a given rational number that is not a perfect square, using technology; e.g., a calculator, a computer.

Q46) *(fill in on the NUMERICAL RESOPNSE bubble sheet)*

A square pyramid in which all edges are the same length has a base area of 100m^2. Find the height of the pyramid to the nearest tenth of a metre.
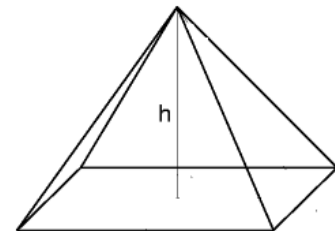
Q47) For the following solutions use a 1 to indicate an exact solution, and a 2 to indicate an approximate solution

    a. $\sqrt{25} = 5$
    b. $\sqrt{24} = 4.9$
    c. $\sqrt{1.524157877} = 1.234567891$
    d. $\sqrt{1.524157878} = 1.23456789$

    _____   _____   _____   _____

    a   b   c   d

Q48) The two whole numbers whose perfect squares are closest to $\sqrt{\frac{730}{10}}$

    a. 8, 9   c. 64, 81
    b. 7, 10   d. 72, 74

Strand: Patterns and Relations (Patterns)

General Outcomes: Use patterns to describe the world and to solve problems.

Specific Outcomes:

1. **Generalize a pattern arising from a problem-solving context, using a linear equation, and verify by substitution.**
    *   Write an expression representing a given pictorial, oral or written pattern.

Q 1) A banquet center is expecting a large group for a conference. They have hexagonal tables which can be arranged to seat different numbers of people, following the pattern set below.
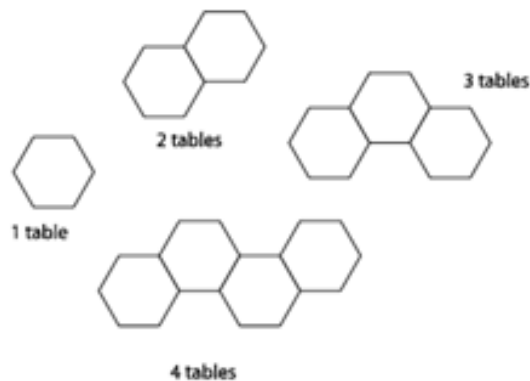
One person sits at each exposed side of a table.

If the group that is coming has 41 members and all hope to be seated at a single, continuous, table arrangement, the number of tables needed is:

Write the expression and solve the answer:

A. 9   C. 11
B. 10   D. 12

- Write a linear equation to represent a given context.

Q 2)

Due to budget cuts, a Math 9 teacher starts driving a cab part time to supplement his income. The fare for the taxi is based on a fixed cost of $4.60 and a cost of $1.75 per kilometre.
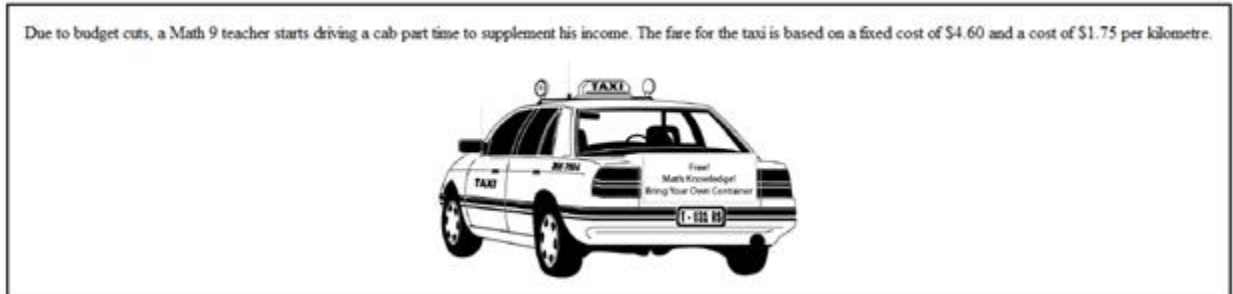
The fare for a 15 km ride would be $ _____ (round your answer to two decimal places)

Write the linear equation and solve.

- Describe a context for a given linear equation.

Q 3)   Write a word problem for the following linear equation and solve:

$$y = 0.75x - 1.50$$

- Solve, using a linear equation, a given problem that involves pictorial, oral and written linear patterns.

Q 4)   LEGEND:
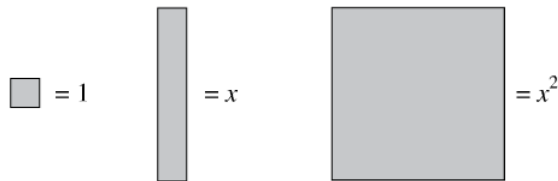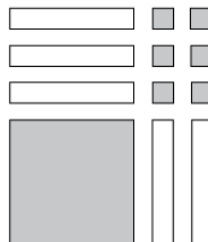
MODEL:

A factorization of the trinomial representation by the algebra-tile model above is:
    A.   (x – 2) (x – 3)
    B.   (x + 3) (x + 2)
    C.   (x +6) ((x – 1)
    D.   (x – 1) (x – 6)

Q 5)

Jin is studying patterns in a linear relation. So he created this table.

x	1	2	3	4	5
y	4	13	22	31	40

If this pattern continues, then when $x = 27$, the value of y will be:

Write the equation and solve.

A. 243

B. 238

C. 233

D. 229

2. **Graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems.**
- Describe the pattern found in a given graph.

Q 6)
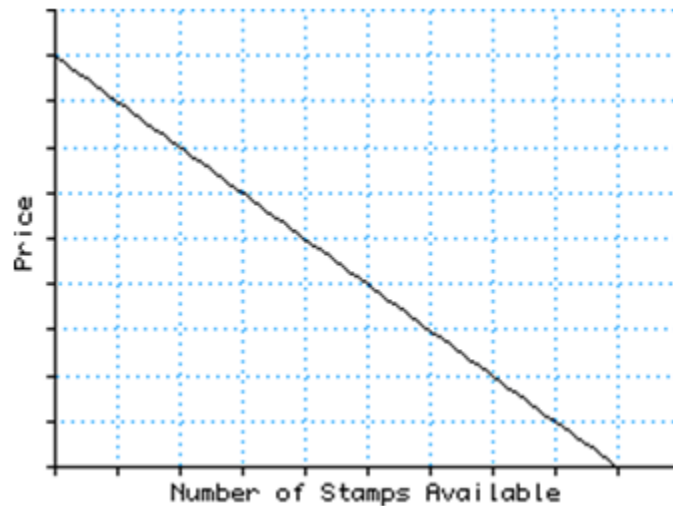
Describe the pattern in the following graph in terms of the relationship between the number of stamps available and their value

- Graph a given linear relation, including horizontal and vertical lines.

Q 7) Plot the following points, draw the graph and state the linear equation.

a)

X	y	(x, y)
0	4	(0, 1)
1	4	(1, 4)
2	4	(2, 4)

b)

x	y	(x, y)
-3	0	(-3, 0)
-3	1	(-3, 1)
-3	2	(-3, 2)

- Match given equations of linear relations with their corresponding graphs.

Q 8) Match given equations of linear relations with their corresponding graphs.

X + 8 = 0

Y – 2 = 0

Y = 2x – 4

Y = x^2

C = 4π
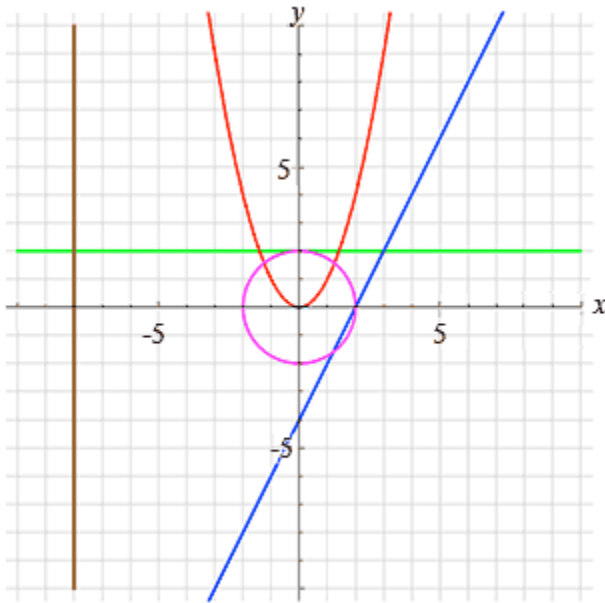
Q 9)

Movers from a particular moving company charge $46.00/hr. Which of the following graphs represents the relationship between the number of hours that the movers work and the total cost of a move?
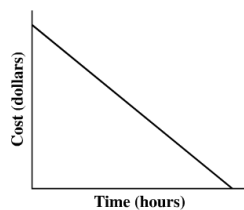

A.
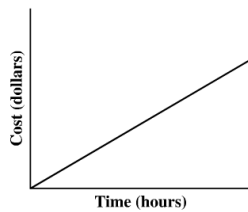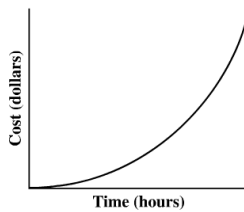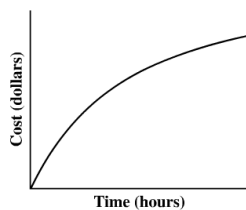
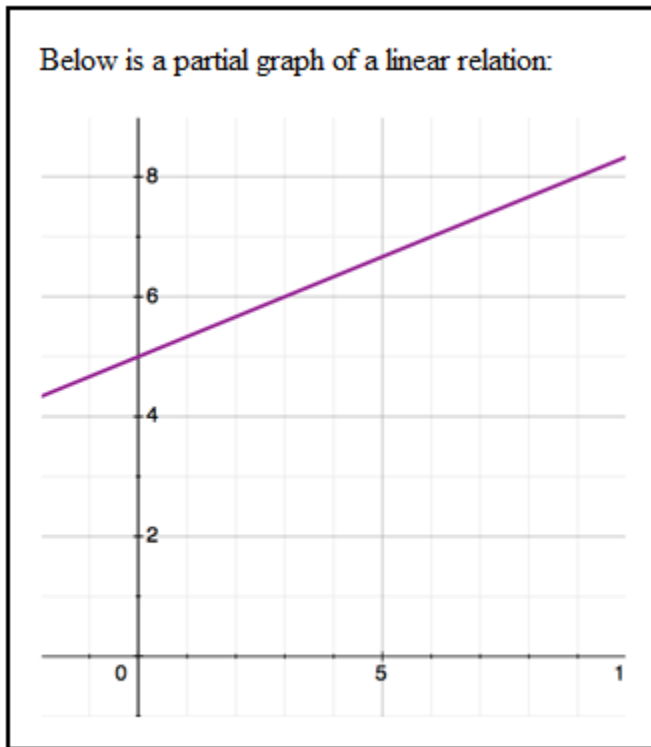Cost (dollars)

Time (hours)

B.

Cost (dollars)

Time (hours)

C.

Cost (dollars)

Time (hours)

D.

Cost (dollars)

Time (hours)

Q 10)

Below is a partial graph of a linear relation:

When $y = 2$, the value of x will be:

Q 11)

Jada is studying patterns in a linear relation. So she created this table.

x	1	3	5	7	9
y			12	13	

Graph the table above and fill in the missing values for y.

Q 12)

Jada is studying patterns in a linear relation. So she created this table.

x	1	3	5	7	9
y			12	13	

If this pattern continues, then when $y = 40$, the value of x will be

A) 61
B) 63
C) 65
D) 67

- Solve a given problem by graphing a linear relation and analyzing the graph.

Strand: Patterns and Relations (Variables and Equations)

General Outcomes: Represent algebraic expressions in multiple ways

Specific Outcomes:

3. **Model and solve problems, using linear equations of the form:**

- $ax = b$
- $\frac{x}{a} = b, a \neq 0$
- $ax + b = c$
- $\frac{x}{a} + b = c, a \neq 0$
- $\frac{a}{x} = b, x \neq 0$ where a, b, c, d, e and f are rational numbers.

- $ax = b + cx$
- $a(x + b) = c$
- $ax + b = cx + d$
- $a(bx + c) = d(ex + f)$

- Model the solution of a given linear equation, using concrete or pictorial representations, and record the process.

Q 13) Illustrate how algebra tiles can be used to determine the factors of 4x^2 – 6x

Q 14)   **2x + y = 1**   **X – 2y = 12**

Q 15) **Solve the following linear equation: 1.15x + 19 = 60**

Q 16)

A student completed the following four steps to solve the equation $\frac{x}{40} + \frac{x}{60} = 1$. However, in one of the steps the student makes a mistake.

Step 1 $120\left(\frac{x}{40} + \frac{x}{60}\right) = 1$

Step 2 $\frac{120x}{40} + \frac{120x}{60} = 1$

Step 3 $3x + 2x = 1$

Step 4 $5x = 1$

Solution $x = \frac{1}{5}$

In which step was the mistake made in solving the equation?

- A. **Step 1**
- B. **Step 2**
- C. **Step 3**
- D. **Step 4**

Q 17) **The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 2200 people enter the fair and $5050 is collected. How many children and how many adults attended?**

Q 18)

Your parents have bought you a cell phone, but you are responsible for paying the monthly payments. Here are the three options.

Plan A: $20 per month inclueds 200 free minutes of air time and 8¢ for each additional minute.

Plan B: $30 per month includes 150 minutes and 5¢ for each additional minute.

Plan C: $40 per month includes unlimited time.

Use the axis provided to determine under what circumstances each of the three plans would be the best choice. Justify your answer.
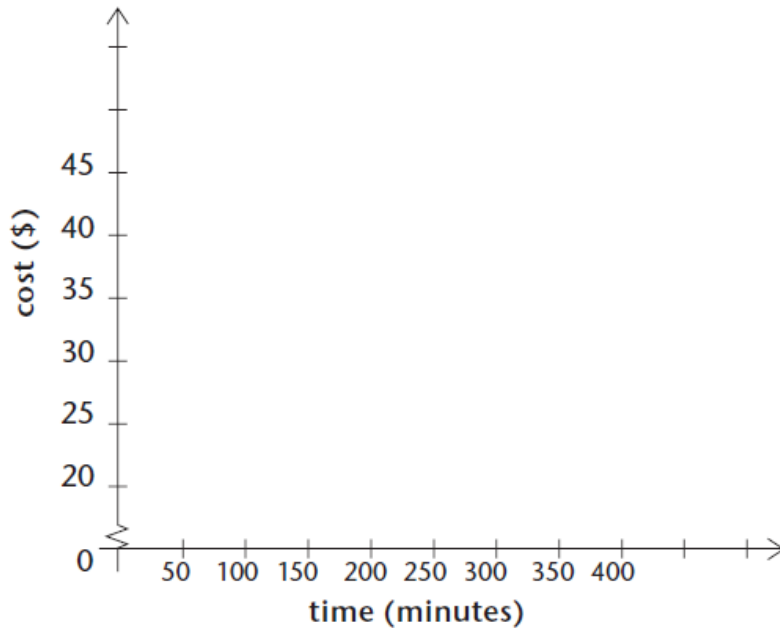
4. **Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context.**

- Translate a given problem into a single variable linear inequality, using the symbols ≥, >, < or ≤.

Q19) *Tom needs to complete a minimum of 175 minutes of trumpet practice each week. Every Monday he practices 35 minutes after school, and does 15 minute sessions thereafter. Express this as an inequality. How many sessions must he do to reach his quota?*

- Determine if a given rational number is a possible solution of a given linear inequality.

Q20) *Given the above inequality, will 9 practice sessions give Tom enough minutes to meet his weekly minimum?*

- Generalize and apply a rule for adding or subtracting a positive or negative number to determine the solution of a given inequality.

Q21) *Identify the operations necessary to determine the solution to the following inequality,*
$$53 < x - 2$$

Q22) *Identify the operations necessary to determine the solution to the following inequality,*
$$4 + y ≤ -12$$

Q23) *What is a general rule for solving inequalities using addition and subtraction?*

- Generalize and apply a rule for multiplying or dividing by a positive or negative number to determine the solution of a given inequality.

Q24) *Identify the operations necessary to complete the operations and inverse operations.*

A. _____

B. _____

C. _____

D. _____
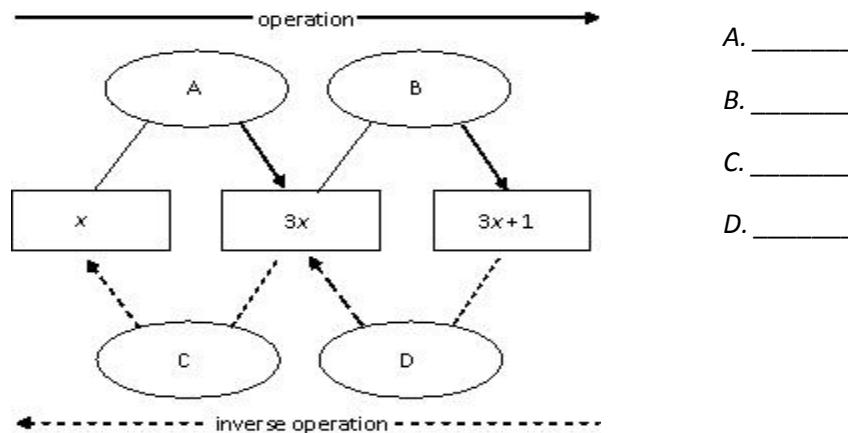
Q25) *Given n > 6, which operations will you use to isolate the variable?*

Q26) *Given -12x < -144, which operations will you use to isolate the variable?*

Q27) *What is a general rule for multiplying and dividing to solve inequalities?*

- Solve a given linear inequality algebraically, and explain the process orally or in written form.

Q28) *Solve the given inequality and write down the steps you followed.*
$3 - 2x \leq 7$

- Compare and explain the process for solving a given linear equation to the process for solving a given linear inequality.

Q29) *Solve for the variable in both given scenarios:*
$-4x - 7 = 21$ $8x + 3 > -29$

Q30) *Explain how solving an equation and an inequality are similar.*

- Graph the solution of a given linear inequality on a # line.

Q31) *Graph the solution to the following linear inequalities on a number line.*
a) $8x + 3 > -29$ c) $-30 < 4.25 + 0.75x$
b) $15 - \underline{d} \leq 10$ d) $-x -12 \geq 18$
        4

- Compare and explain the solution of a given linear equation to the solution of a given linear inequality.

Q32) *Solve the given equation and inequality.*
$X + 2 < -5$ $x + 2 = 5$

Q33) *How are the solutions to the above equation and inequality different? Explain what this difference means.*

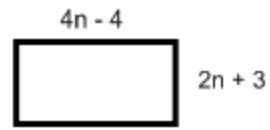- Verify the solution of a given linear inequality, using substitution for multiple elements in the solution.

Q34) *Is (3, 1) a solution to 2x – 3y > 6? Explain.*

Q35) *Is (8, 2) a solution to 2x – 3y > 6? Explain.*

Q36) *This rectangle must have a perimeter less than or equal to 100cm.*

a)Write an inequality for this situation.
b) Solve the inequality
c) Represent the solution graphically

4n - 4

2n + 3

5. **Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2).**
   - Create a concrete model or a pictorial representation for a given polynomial expression.

Q37) Simplify the following expression, and represent with algebra tiles:

$$5x^2 + 3x - 4x - 8x^2 + 1$$

- Write the expression for a given model of a polynomial

Q38)

Write a simplified polynomial for each set of tiles.

a)

b)

Q39)

Identify the polynomials that can be represented by the same set of algebra tiles.

i) $3x^2 - 2 + 6x$

ii) $3x^2 - 6x + 2$

iii) $-2 + 6x - 3x^2$

iv) $6x - 2 + 3x^2$

a. iii and iv   b. i and iv   c. ii and iv   d. i and ii

Q40)   *a) State the variables, degree, number of terms, coefficients, and the number of terms:*
$$4x^2y^6z - 10y^3 - 7$$

b) Simplified, what is the coefficient and constant $-5x + 6 - 4x - 8 + x$

Q41) Describe this situation using a polynomial. Aaron puts $15 in the bank every week. He started with $48. How much money does he have after *n* weeks?

Q41)   Identify which polynomials are equivalent.
Explain how you know.

a)

b)

c)

d)

e)

f)

6. **Model, record and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially and symbolically (limited to polynomials of degree less than or equal to 2).**

Q42)   Name the polynomials modelled. Then determine the sum.

and

Q43) Model the sums. Then write a simplified polynomial for the sum.

$$(-3x^2 + 2xy + 5) + (3x^2 - 4xy - 7)$$

Q44) Express the perimeter as a simplified polynomial.

$x + 1$

$2x - 4$

$3x - 1$

$2x + 8$
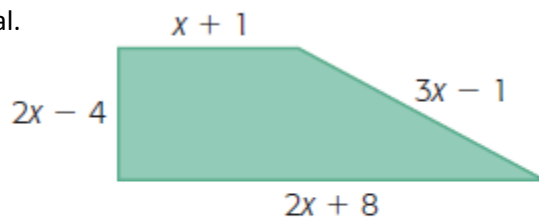
Q45) The perimeter of this isosceles triangle is represented by the polynomial $15p + 12$. Write a simplified polynomial for the length of the unknown side.

$5p + 3$

?
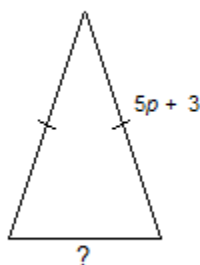
a. $25p + 18$ b. $5p + 6$ c. $10p + 9$ d. $5p + 3$

- Model subtraction of two given polynomial expressions concretely or pictorially, and record the process symbolically.

Q46) Model the differences using algebra tiles. Then record a simplified polynomial for the difference.

$$(-x^2 + 3xy + 2) - (3x^2 - xy - 4)$$

Q47) A large white square represents an x^2-tile, a large black square represents a $-x^2$-tile, a white rectangle represents an x-tile, a black rectangle represents a $-x$-tile, a small white square represents a 1-tile, and a small black square represents a -1-tile.

Write the simplified polynomial.
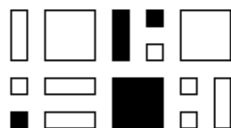
a. $3x^2 + 5x + 6$ b. $-x^2 - 3x - 2$ c. $x^2 + 3x + 2$ d. $x^2 - 3x + 2$

Q48) The perimeter of a football field can be represented by $10x^2 - 6x + 14$. The width of the football field is $2x^2 - 4x - 2$. What is the length of the football field?

Q49) The polynomial $5w + 11$ represents the cost, in dollars, of shipping a parcel with mass w kg by ground. The polynomial $9w + 14$ represents the cost of shipping a parcel with mass w kg by air.
a) Write a polynomial for the difference in the costs of the two methods of shipping.
b) How much more does it cost to ship a 15-kg parcel by air?

Q50) The polynomial $40p + 50f + 90$ represents the amount of ink, in millilitres, of printing p posters and f flyers in colour. The polynomial $15p + 20f + 45$ represents the amount of ink, in millilitres, of printing p posters and f flyers in black-and-white.
a) Write a polynomial for the difference in the amount of ink needed to print the two types of posters and flyers.
b) How much ink is saved if someone prints 210 posters and 180 flyers in black-and-white instead of colour?
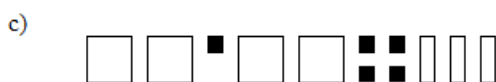
- Identify like terms in a given polynomial expression.

Q51) Identify the like terms:

$$3x^2, \ 4x, \ -5, \ -9x^2, \ 7y, \ x, \ 0, \ \frac{2y}{11}$$

- ~~Apply a personal strategy for addition or subtraction of two given polynomial expressions, and record the process symbolically.~~
- ~~Refine personal strategies to increase their efficiency.~~

- Identify equivalent polynomial expressions from a given set of polynomial expressions, including pictorial and symbolic representations.

Q52) Identify which polynomials are equivalent. Explain how you know.
a)

b)

c)

d)

e)

- Identify the error(s) in a given simplification of a given polynomial expression.

f)

Q53) A student subtracted like this:

$(8x^2 - 3x + 7) - (5x^2 + 5x - 5)$

$= 8x^2 - 3x + 7 - 5x^2 + 5x - 5$

$= 8x^2 - 5x^2 - 3x + 5x + 7 - 5$

$= 3x^2 + 2x + 2$

Q54) A student added $(8x^2 - 6x + 13) + (-13x + 6x^2 - 8)$ as follows:

$(8x^2 - 6x + 13) + (-13x + 6x^2 - 8)$

$= 8x^2 - 6x + 13 + 13x + 6x^2 - 8$

$= 8x^2 + 6x^2 - 6x + 13x + 13 - 8$

$= 14x^2 + 7x + 5$

Is the student's work correct? If not, explain where the student made any errors and write the correct answer.

7. **Model, record and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically.**
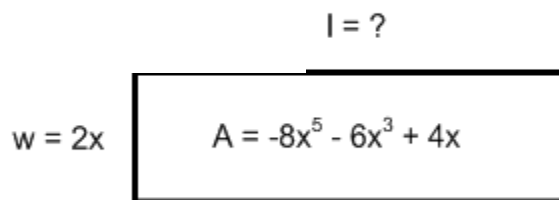
- Model multiplication of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically.

Q55) Write the following as a simplified expression of area

a)

2

b)

c)

$-2x^2 - 5x + 4$

$3x^2$ What is the area?
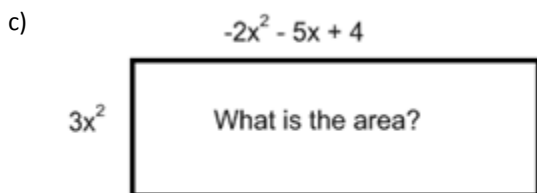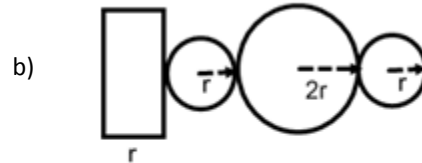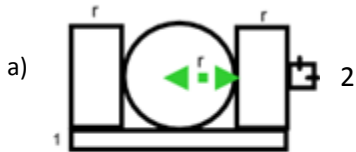
- Model division of a given polynomial expression by a given monomial concretely or pictorially, and record the process symbolically.

Q56) Determine the length.

$l = ?$

$w = 2x$ $A = -8x^5 - 6x^3 + 4x$

Q57) Simplify:

(a) $(-15x^2 + 25xy - 30x) \div (5x)$

(b) $-2x(3x^2 + x - 5)$

Q58) Which of these products are equivalent?

A. $4(3x^2 - 2x - 1)$ C. $4x(3x - 2 - 1)$

B. $2(6x^2 - x - 2)$ D. $2(6x^2 - 4x - 2)$

Q59) Identify the equivalent polynomials. Explain how you know.

i) $3x^2 + 3x - 4 + 2x^2 - 6x - 3$

ii) $x^2 + 12 + 2x - 5 - 5x + 4x^2$

iii) $3x^2 - 6x + 2x^2 + 3 + 3x - 10$

Q60) How would you help Rachel understand that her subtraction is incorrect?

$(-2p^2 - 4q + 8) - (5p^2 + 8q - 2) = 3p^2 - 12q + 6$

Q61)

Larissa divided $(4y^2 + 2x - 2xy)$ by 2 and got $4y + x - xy$. Is she correct? If so, explain why. If not, correct the quotient.

Strand: Shape and Space (Measurement)

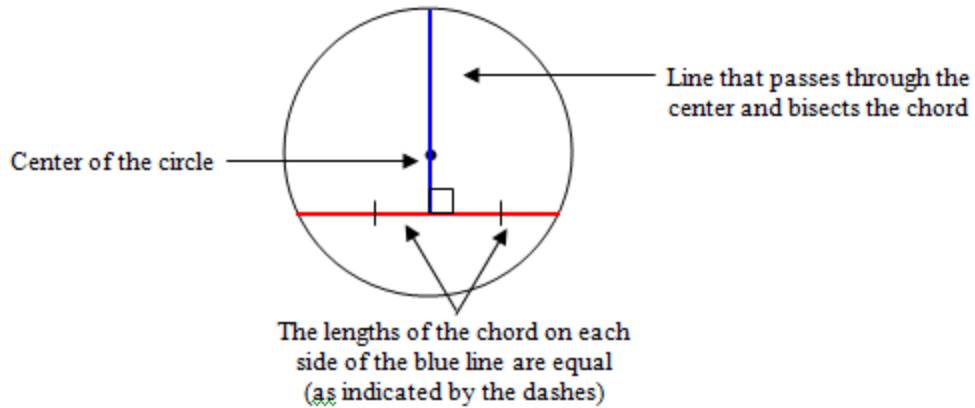## General Outcome: Use direct and indirect measurement to solve problems.

1. Solve problems and justify the solution strategy, using the following circle properties:

> • **the perpendicular from the centre of a circle to a chord bisects the chord**

> • **the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc**

> • **the inscribed angles subtended by the same arc are congruent**

> • **a tangent to a circle is perpendicular to the radius at the point of tangency.**

- Provide an example that illustrates the perpendicular from the centre of a circle to a chord bisects the chord
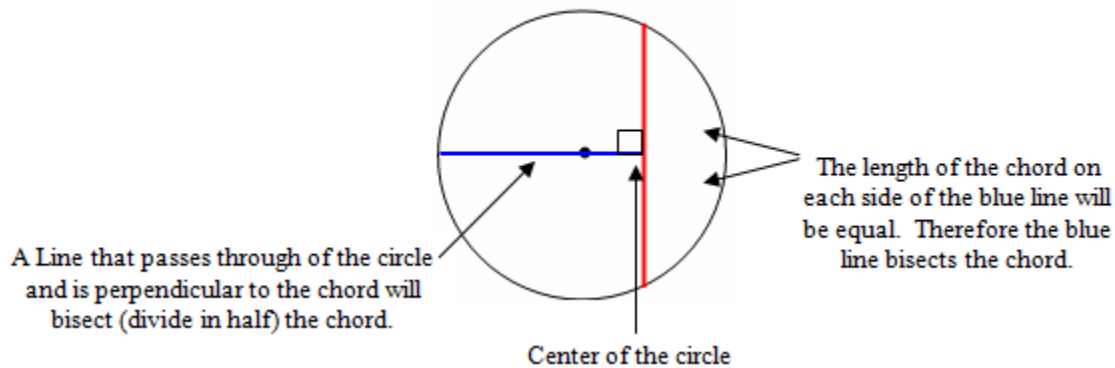
Chord
A line that joins any 2 points on the circle and does not pass through the middle of the circle

Diameter
The line that joins 2 points on the circle and passing through the middle

The center of the circle

Radius
A line that connects the middle of the circle to any point that falls on the circle
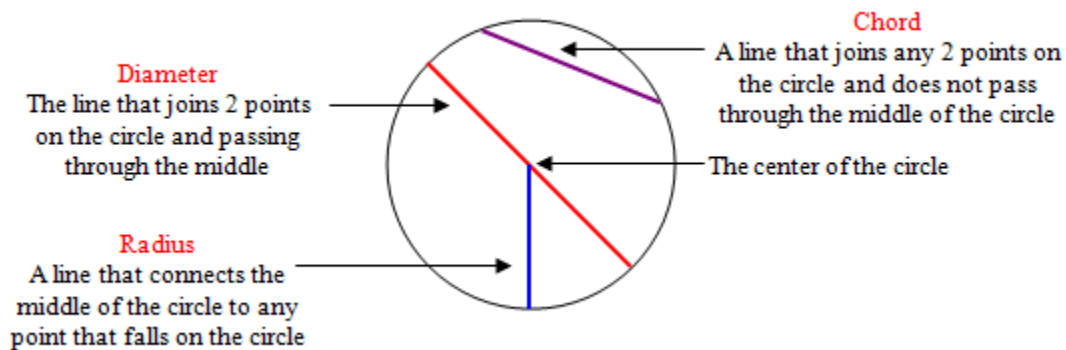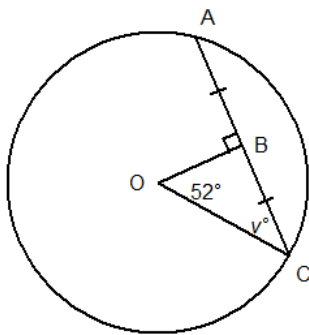
Properties of Chords

1. A line through the center of a circle that bisects (divides in half) the chord is perpendicular (at an angle of 90^0) to the chord. This line is called a perpendicular bisector.

Line that passes through the center and bisects the chord

Center of the circle

The lengths of the chord on each side of the blue line are equal (as indicated by the dashes)

2. The perpendicular from the center of a circle to a chord will bisect the chord.

A Line that passes through of the circle and is perpendicular to the chord will bisect (divide in half) the chord.

The length of the chord on each side of the blue line will be equal. Therefore the blue line bisects the chord.

Center of the circle

Q1) O is the centre of the circle.
Determine the value of $v°$.

A

B

O

$52°$

$v°$

C

a. $19°$ b. $71°$ c. $52°$ d. $38°$

Q2)   O is the centre of the circle.
Determine the value of n to the nearest tenth, if necessary.
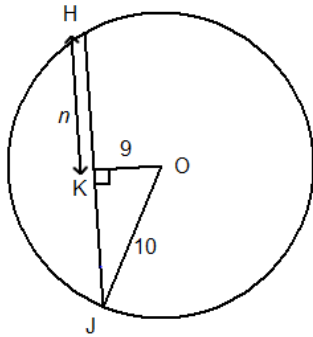
- Provide an example that illustrates the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc
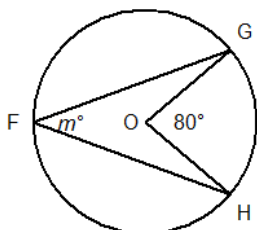
Q3)
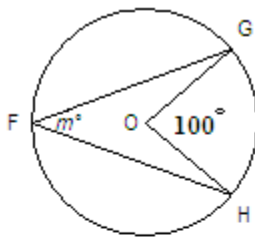
Solution

$<$ GFH is ½ of $<$GOH

$$\frac{100°}{2} = 50°$$

Therefore, m° = 50°

Property used: The measure of the central angle twice the measure of the inscribed angle subtended by the same arc.

Q4)   O is the centre of this circle.
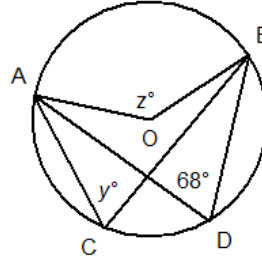Determine the value of $m°$.

a.   90°   c.   180°
b.   80°   d.   40°

Q5) O is the centre of this circle. Determine the value of $c°$.
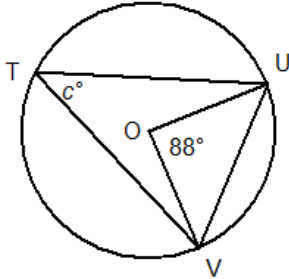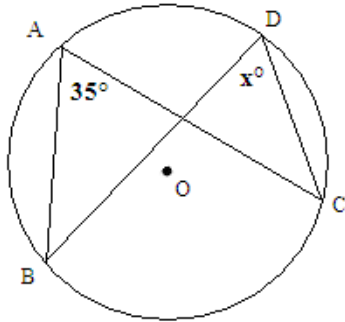

Q6) Point O is the centre of this circle. Determine the values of $y°$ and $z°$.
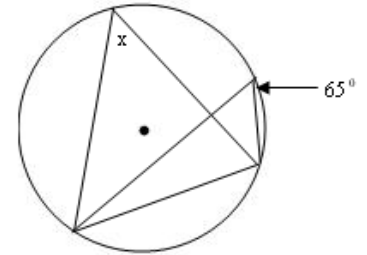

- Provide an example that illustrates the inscribed angles subtended by the same arc are congruent

Q7) Find the value of $x°$.

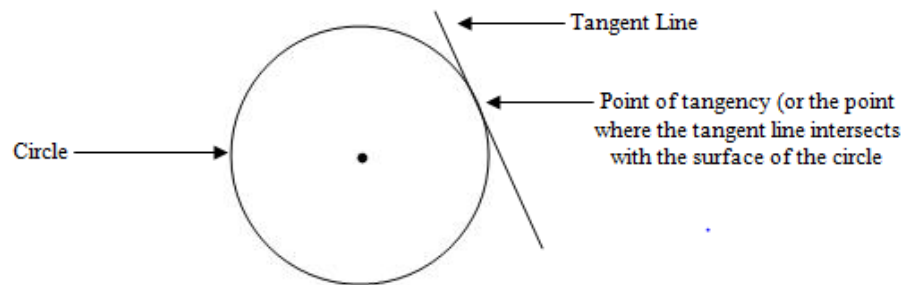**Q8)** Determine the value of x in the following diagram.

Solution

Notice that these 2 angles are both formed using the same arc. Therefore the inscribed angles are equal.

a. 44°
b. 90°

c. 180°
d. 88°

Tangents

A tangent is simply a line that intersects with a circle at only one point. The following diagram provides an example of a tangent:

Circle ———————→ ⦿   ————— Tangent Line

————— Point of tangency (or the point where the tangent line intersects with the surface of the circle

Properties of Tangents

1. A tangent to a circle is perpendicular to the radius at the point tangency.

————— Radius

Tangent to the circle ——————→
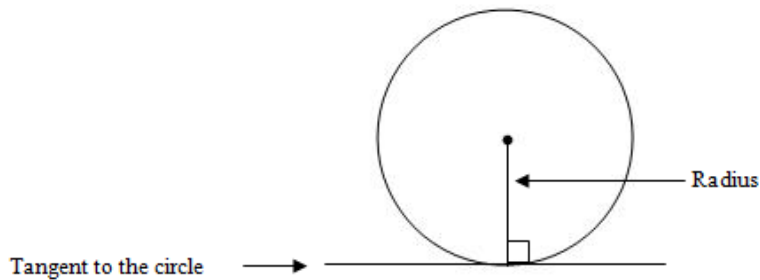
2. The tangent segments to a circle from an external point are equal. In other words, 2 tangents of the circle that meet at an external point will have the same distance from the point of tangency to the external point.
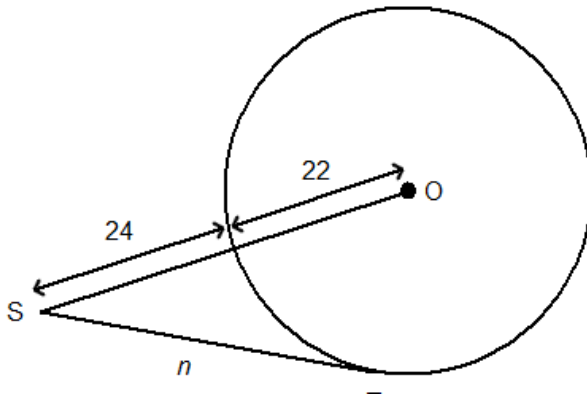
————— Tangent

————— External point
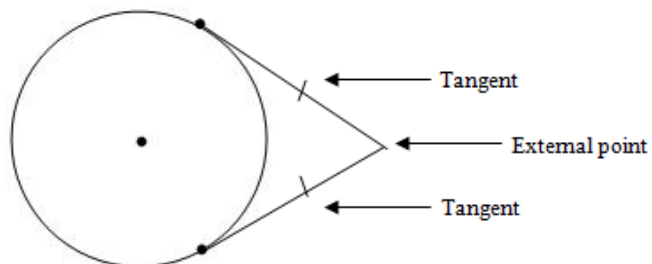
————— Tangent

O is the centre of this circle and point A is a point of tangency.

Q9) Determine the value of *m*. If necessary, give your answer to the nearest tenth.

A

25

m

O

25

B

38
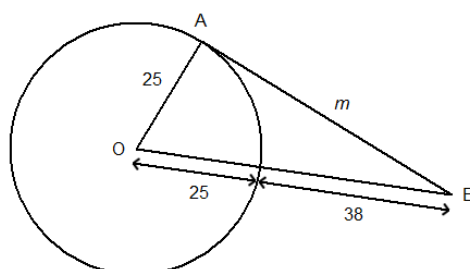
O is the centre of this circle and point T is a point of tangency.
Determine the value of *n*. If necessary, give your answer to the nearest tenth.

- Solve a given problem involving application of one or more of the circle properties
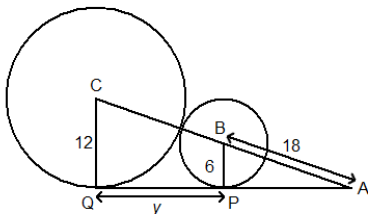
Q11)   A circular mirror with radius 27 cm hangs from a hook.
The wire is 46 cm long and is a tangent to the circle at points A and B.
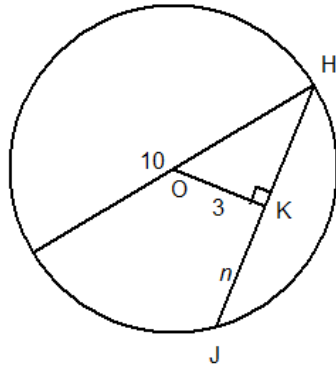How far, to the nearest tenth, above the top of the mirror is the hook?
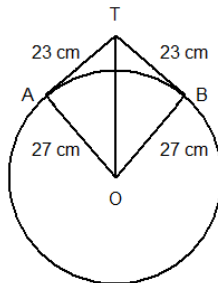
Q12)

AQ is a tangent to the circle with centre B and to the circle with centre C.
The points of tangency are P and Q.
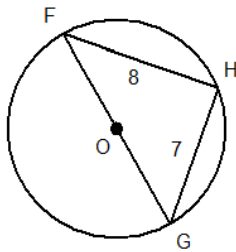Determine the value of *y* to the nearest tenth.

. Point O is the centre of this circle.
Determine the value of n to the nearest tenth, if necessary.

- Determine the measure of a given angle inscribed in a semicircle, using the circle properties.

Q14) Point O is the centre of the circle.
Determine the radius of the circle to the nearest tenth.
What circle property did you use?

Q15) Determine the value of "x" in the following diagram.
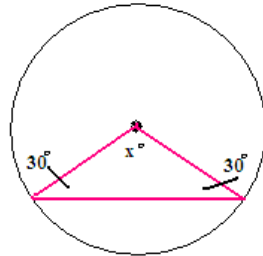
- Explain the relationship among the centre of a circle, a chord and the perpendicular bisector of the chord.

Q16) A pedestrian underpass is constructed using a cylindrical pipe of radius 2.6 m. The bottom of the pipe will be filled and paved. The headroom at the centre of the path is 3.9 m.
How wide is the path to the nearest tenth of a metre?

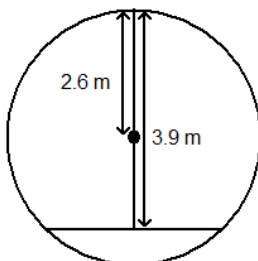## Strand: Shape and Space (3-D Objects and 2-D Shapes)

General Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

2. **Determine the surface area of composite 3-D objects to solve problems**

- Determine the area of overlap in a given composite 3-D object, and explain the effect on determining the surface area (limited to right cylinders, right rectangular prisms and right triangular prisms).

QUESTION 1

This object is made from 7 centimetre cubes. Determine its surface area.
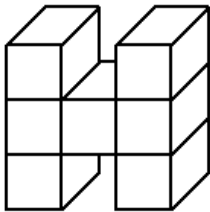
a.   30 cm²   b.   42 cm²   c.   26 cm²   d.   22 cm²

QUESTION 2

Two identical equilateral triangular prisms are joined by a cylinder as shown.
The equilateral triangle has side length 14 cm and the rectangular sides have length 5 cm.
The cylinder has diameter 5 cm and length 9 cm.
Determine the surface area of the composite object, to the nearest square centimetre.
Show your work.

9 cm

14 cm   5 cm
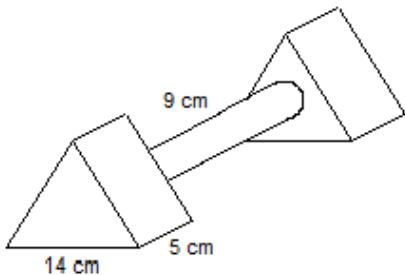
QUESTION 3

Each layer of a three-layer cake is a cylinder of height 8 cm.
The bottom layer has diameter 28 cm.
The middle layer has diameter 24 cm.
The top layer has diameter 20 cm.
The surface of the cake is frosted. What area of the cake is frosted?

- Determine the surface area of a given composite 3-D object (limited to right cylinders, right rectangular prisms and right triangular prisms).

QUESTION 4

This object is made of a right rectangular prism of length 12 cm, width 6 cm, and height 4 cm.
A cube of side length 2 cm has been removed from one corner.
Determine the surface area of the object.

2 cm

4 cm

6 cm
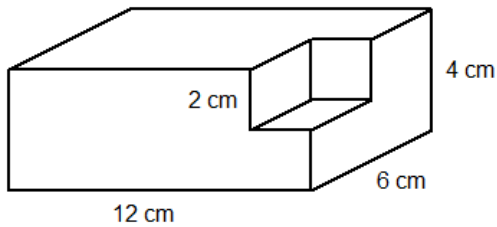
12 cm

a. 312 cm²   b. 264 cm²   c. 288 cm²   d. 280 cm²

QUESTION 5

This object is composed of a cylinder of diameter 4 cm and height 14 cm on top of another cylinder of diameter 12 cm and height 4 cm.
Determine the surface area of the object, to the nearest square centimetre.
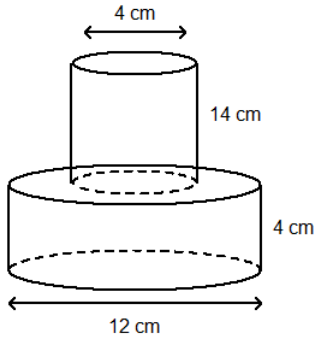
a. 440 cm²   b. 557 cm²   c. 561 cm²   d. 553 cm²

QUESTION 6

This object is composed of three identical cylinders and a right rectangular prism.
Each cylinder has diameter 8 cm and height 5 cm.
The rectangular prism has length 36 cm and square ends of side length 8 cm.
Determine the surface area of the object, to the nearest square centimetre.
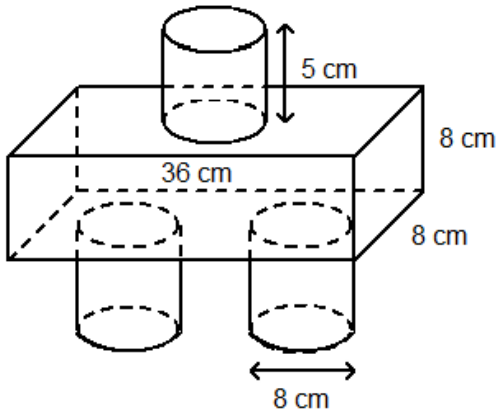
- Solve a given problem involving surface area.

Determine the total surface area of this object, to the nearest square centimetre.
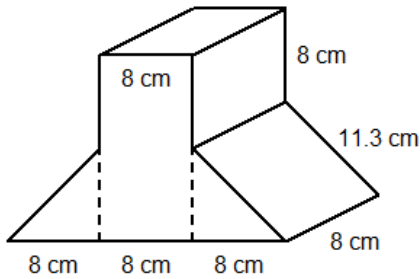
a. 1039 cm²   b. 1130 cm²   c. 949 cm²   d. 859 cm²

3. Demonstrate an understanding of similarity of polygons.

- Determine if the polygons in a given pre-sorted set are similar, and explain the reasoning.

QUESTION 8

Which triangle is similar to ΔABC?
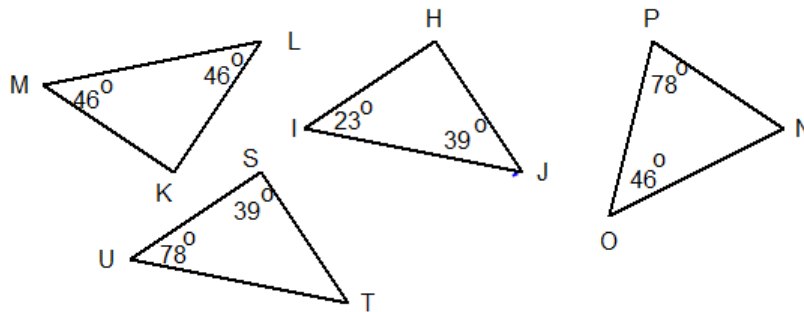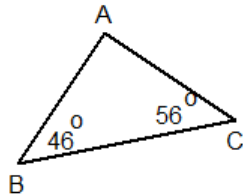
- Draw a polygon similar to a given polygon, and explain why the two are similar.

QUESTION 9
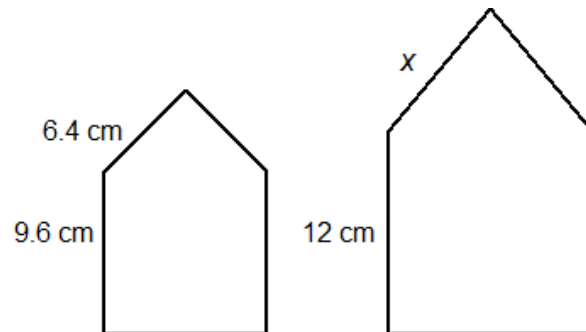
- Solve a given problem, using the properties of similar polygons.

QUESTION 10

These three rectangles are similar.
a) Determine the values of x and y.
b) Griswald draws another similar rectangle with width 70.4 cm. What is its length?
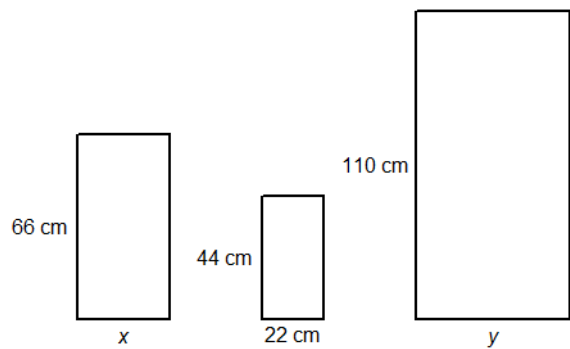
Strand: Shape and Space (Transformation)

General Outcome: Describe and analyze position and motion of objects and shapes.

4. Draw and interpret scale diagrams of 2-D shapes.

- Identify an example of a scale diagram in print and electronic media, e.g., newspapers, the Internet, and interpret the scale factor.

QUESTION 1

Using the figure above, what is the area of the window if the length is .03m and the width is .02m on the drawing and the scale factor is 90.

Solution

$$\text{Scale Factor} = \frac{\text{Length of enlargement (scaled diagram)}}{\text{Length of original}}$$

$$90 = \frac{x}{0.03}$$

$$x = (90)(0.03) = 2.7m$$

$$90 = \frac{x}{0.02}$$

$$x = (90)(0.02) = 1.8m$$

$$A = (2.7)(1.8m) = 4.86m^2$$

- Draw a diagram to scale that represents an enlargement or a reduction of a given 2-D shape.

QUESTION 2

Determine the scale factor for this reduction.
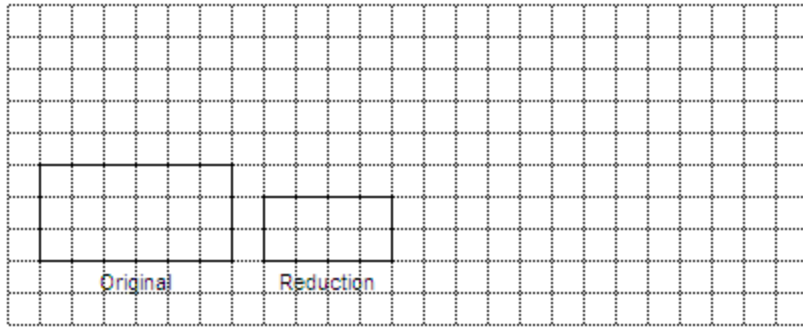
- Draw a scale diagram of this figure with a scale factor of 2.

QUESTION 3
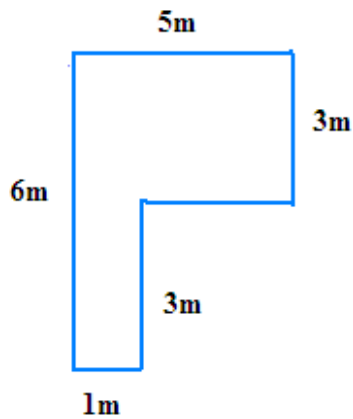
QUESTION 4

In a photo, the length of a model car is 4.4 cm.
The photo is to be enlarged by a scale factor of 6.5.
Determine the length of the car in the enlargement.

a. 57.2 cm   b. 10.9 cm   c. 21.8 cm   d. 28.6 cm

- Determine the scale factor for a given diagram drawn to scale.

QUESTION 5

Determine the scale factor for this reduction.
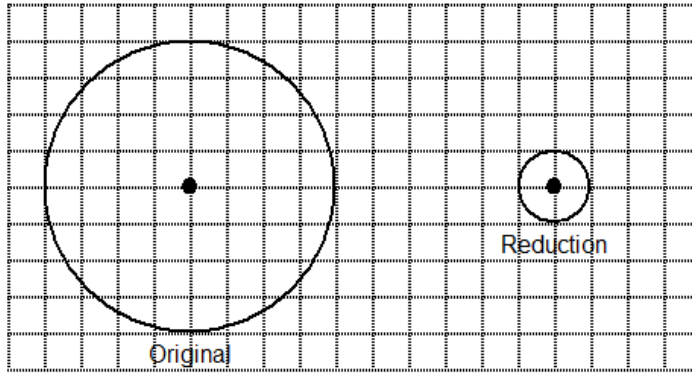
a. 8   b. 4   c. $\dfrac{1}{4}$ d. $\dfrac{1}{8}$

QUESTION 6

A scale diagram of a hotel room is shown below. The length of the room is 6.6 m.
a) Determine the scale factor. Explain what it means.
b) What are the actual dimensions of the bed, couch, and desk?
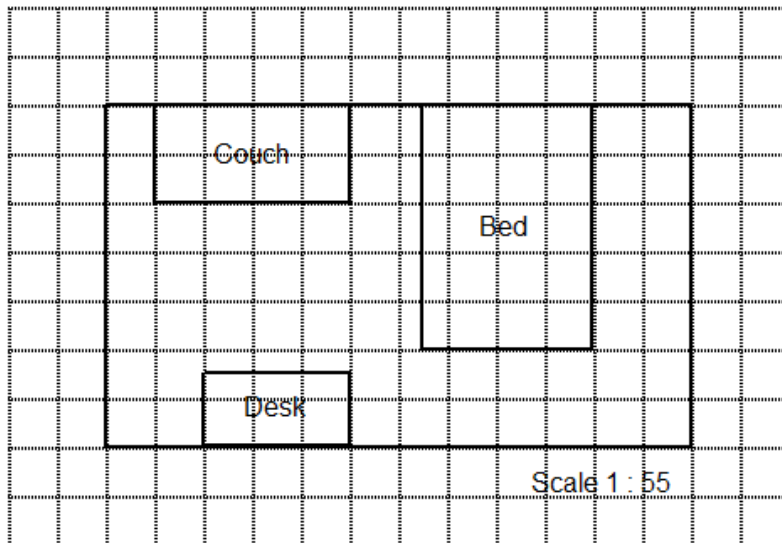
- Determine if a given diagram is proportional to the original 2-D shape, and, if it is, state the scale factor.

QUESTION 7

A model ship is built to a scale of 1:400.
If the actual length of the ship is 45 m, determine the length of the model.
Give your answer to the nearest tenth of a centimetre, if necessary.

a. 11.3 cm	b. 35.5 cm	c. 0.11 cm	d. 8.9 cm

- Solve a given problem that involves the properties of similar triangles.

QUESTION 8

Which triangle is similar to ΔABC?
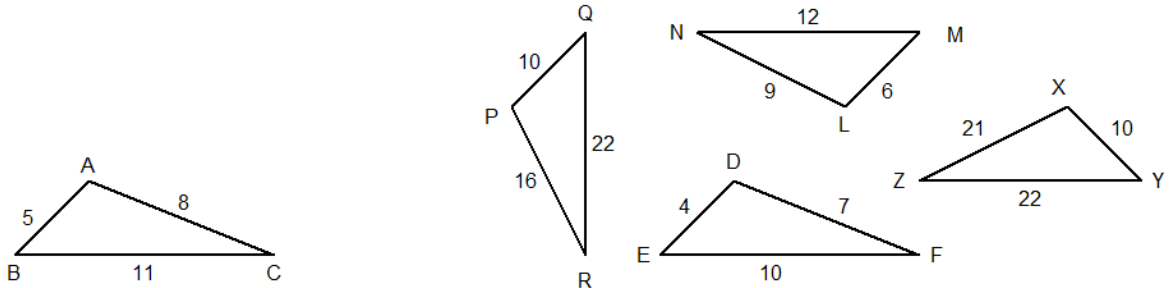
QUESTION 9

These triangles are similar. Complete the ratios of the corresponding sides: $\dfrac{PQ}{} = \dfrac{PR}{} = \dfrac{QR}{}$
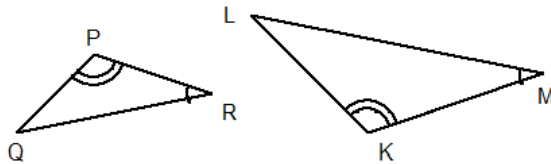
a. $\dfrac{PQ}{KL} = \dfrac{PR}{LM} = \dfrac{QR}{KM}$

b. $\dfrac{PQ}{LM} = \dfrac{PR}{KM} = \dfrac{QR}{KL}$

c. $\dfrac{PQ}{KM} = \dfrac{PR}{KL} = \dfrac{QR}{LM}$

d. $\dfrac{PQ}{KL} = \dfrac{PR}{KM} = \dfrac{QR}{LM}$

Determine the length of EB in this pair of similar triangles.
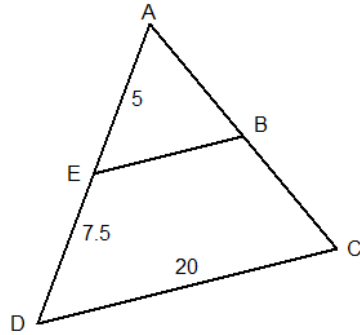
a.   13.3   b.   10   c.   8   d.   5

5. Demonstrate an understanding of line and rotation symmetry.

- Classify a given set of 2-D shapes or designs according to the number of lines of symmetry.

QUESTION 11

Which shapes have at least 2 lines of symmetry?
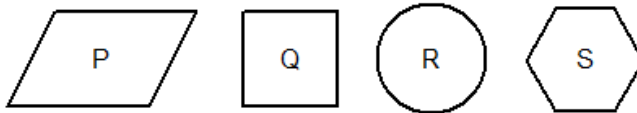
a.   Shapes P, Q, S   c.   Shapes Q, R, S
b.   Shapes P, S   d.   Shapes P, Q, R, S

How many lines of symmetry does this tessellation have?
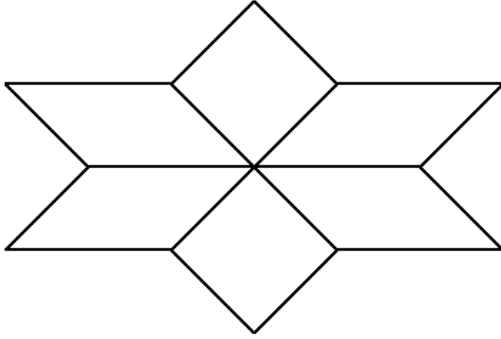
a. 6   b. 2   c. 4   d. 1

- Complete a 2-D shape or design, given one half of the shape or design and a line of symmetry.

Which example shows a reflection of triangle X in the dotted line?

Example i

Example ii

Example iii

Example iv
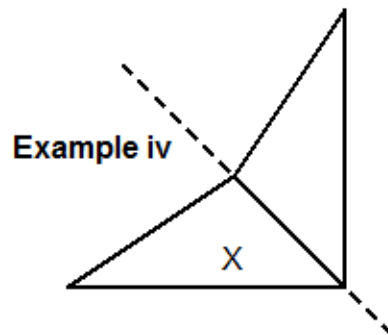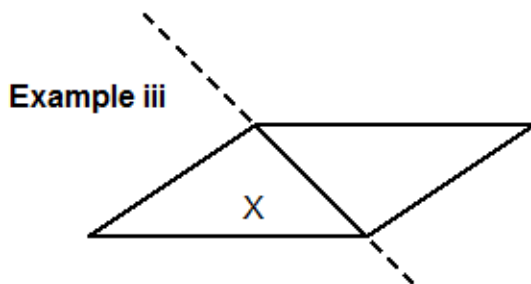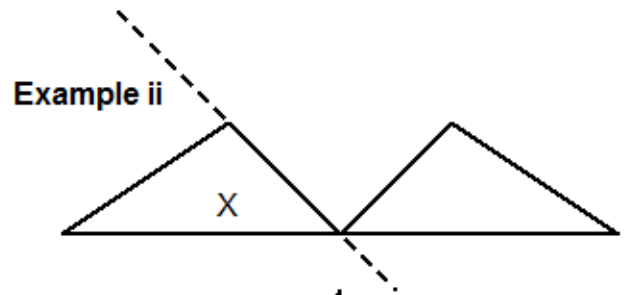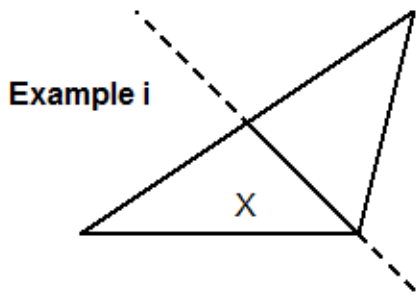
- Determine if a given 2-D shape or design has rotation symmetry about the point at its centre, and, if it does, state the order and angle of rotation.

QUESTION 14

What is the order of rotational symmetry and angle of rotation symmetry for this regular pentagon?
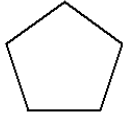
a. 5; 75°   b. 6; 120°   c. 5; 72°   d. 5; 54°

QUESTION 15

What is the order of rotational symmetry and angle of rotation symmetry for this design?
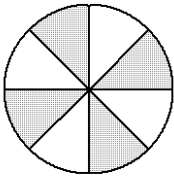
a. 4; 90°   b. 6; 120°   c. 8; 60°   d. 8; 45°

- Rotate a given 2-D shape about a vertex, and draw the resulting image.

QUESTION 16

a) Rotate △ABC 90° clockwise about vertex C. Draw the rotation image.
b) Rotate △ABC 180° clockwise about vertex C. Draw the rotation image.
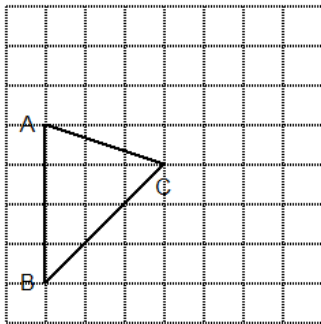
- Identify a line of symmetry or the order and angle of rotation symmetry in a given tessellation.

QUESTION 17
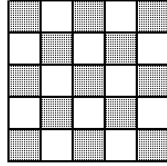
- Identify the type of symmetry that arises from a given transformation on a Cartesian plane.

QUESTION 18
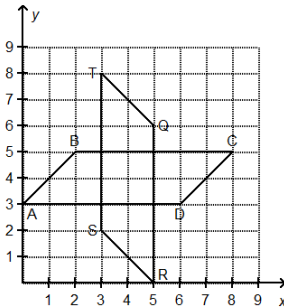
- Complete, concretely or pictorially, a given transformation of a 2-D shape on a Cartesian plane; record the coordinates; and describe the type of symmetry that results.

QUESTION 19

This polygon is part of a larger shape.
Draw the image of the polygon after each reflection:
i)   a reflection in the y-axis
ii) a reflection in the x-axis
iii) a reflection in the oblique line through (–5, 5) and (5, –5)
How many lines of symmetry does the shape have?
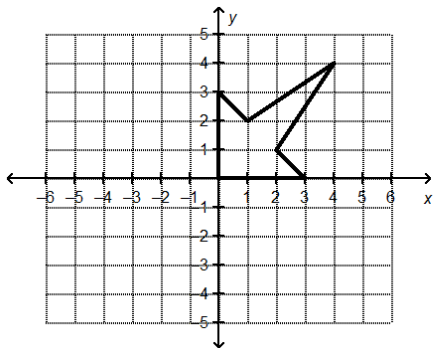
- Identify and describe the types of symmetry created in a given piece of artwork.

QUESTION 20
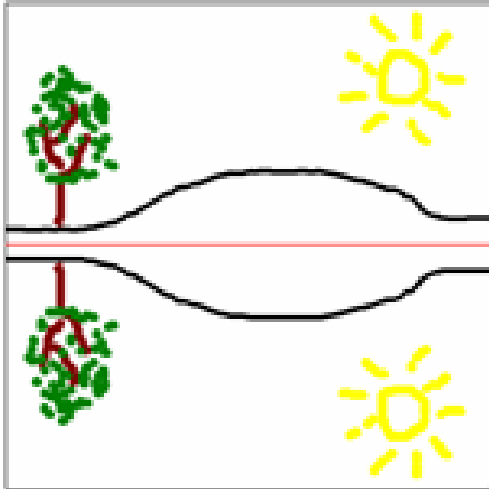
- Determine whether or not two given 2-D shapes on a Cartesian plane are related by either rotation or line symmetry

QUESTION 21

This design was created by reflecting quadrilateral A to create quadrilaterals B, C, and D. Describe the reflections.
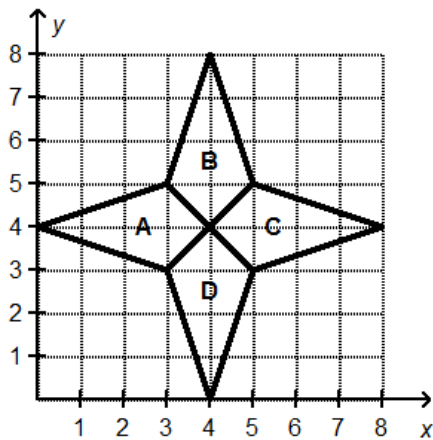
- Draw, on a Cartesian plane, the translation image of a given shape, using a given translation rule such as R2, U3 or → →, ↑ ↑ ↑; label each vertex and its corresponding ordered pair; and describe why the translation does not result in line or rotation symmetry.

QUESTION 22

Mapping

(x, y) → (x + 10, y − 3)
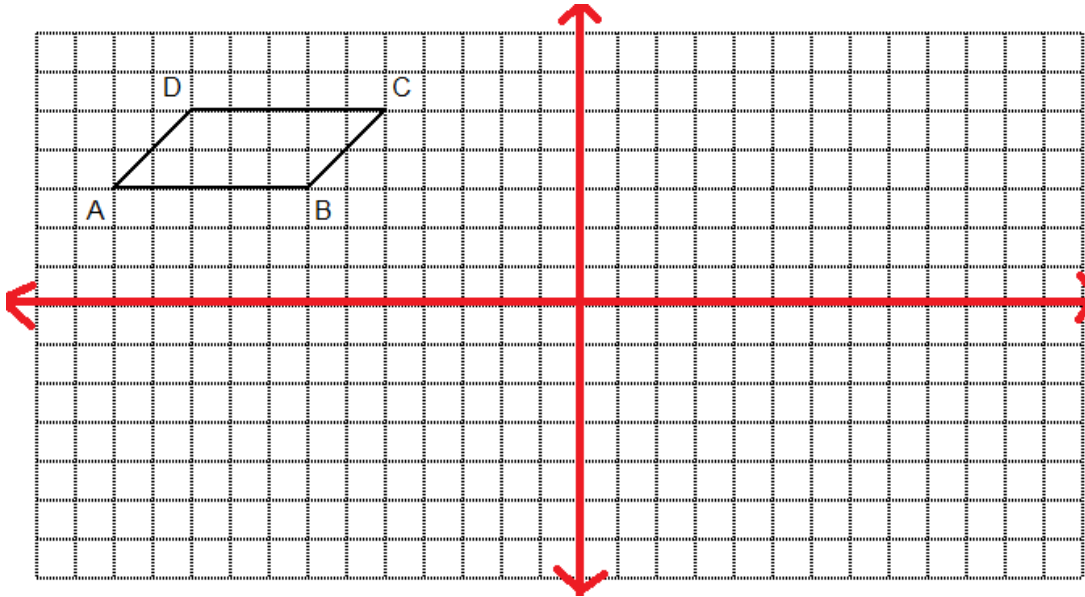
On a grid, draw ΔOAB with vertices O(0, 0), A(4, 2), and B(2, 6).
a) Draw a scale diagram of ΔOAB with scale factor 2 and one vertex at (1, 1).
   Write the coordinates of the vertices of the new triangle.
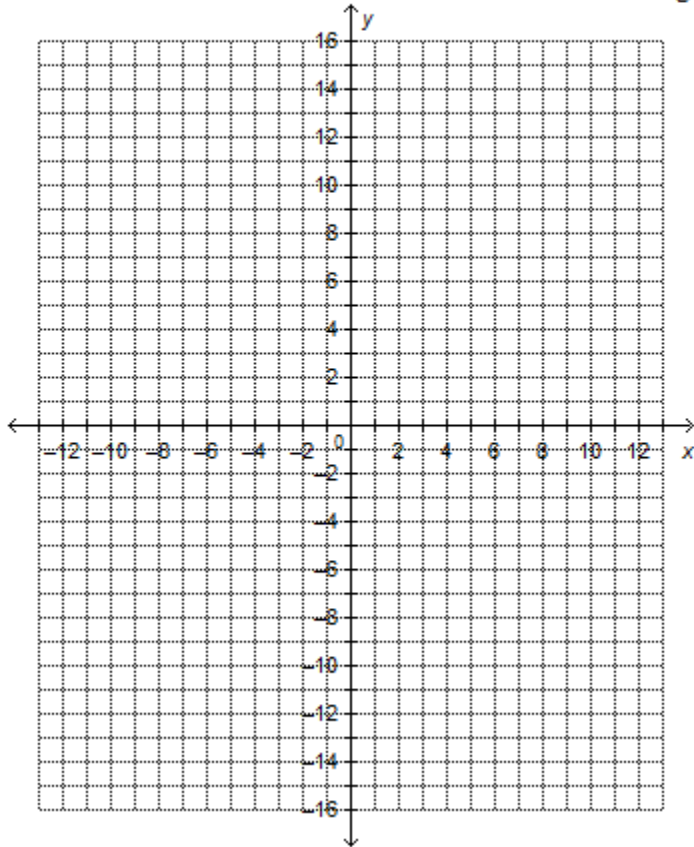
- Create or provide a piece of artwork that demonstrates line and rotation symmetry, and identify the line(s) of symmetry and the order and angle of rotation.

QUESTION 24

Strand: Statistics and Probability (Data Analysis)

General Outcome: Collect, display and analyze data to solve problems.

1**. Describe the effect of:**

- **bias**

- **use of language**

- **ethics**

- **cost**

- **time and timing**

- **privacy**

- **cultural sensitivity on the collection of data.**

  - Analyze a given case study of data collection; and identify potential problems related to bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity.

QUESTION 1

On a hot sunny day in June, teenagers were surveyed to find out how they feel about the city building a new outdoor ice skating rink. In this survey, which of the following might be a problem?
i)   Cultural sensitivity
ii) Timing
iii) Use of Language
iv) Privacy
a. i   b. ii   c. iii   d. iv

Solution
B (timing)

Surveying about a ice rink (typically a winter sport) in the summer.

QUESTION 2

In late November Anita surveyed every student in her class to find out their favourite Christmas carols. Which of the following might be a problem?
i)   Timing
ii) Use of Language
iii) Cultural sensitivity
iv) Cost

a. i   b. iii   c. iv   d. ii

Solution

B (cultural sensitivity)
Individual beliefs is a factor to consider

- Provide examples to illustrate how bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity may influence data.

QUESTION 3

A school principal interviewed a group of students.
He asked them: "Do you like school?"
In this survey, which of the following might be a problem with this question?
i)   Privacy
ii) Cultural sensitivity
iii) Use of Language
iv) Cost

a. iv   b. iii   c. ii   d. i

QUESTION 4

Marjorie wanted to collect information about the sports her classmates were interested in. She prepared a 10 min questionnaire which she gave to her classmates the day before the final math exam.
In this survey, which of the following might be a problem with this question?
i)   Privacy
ii) Timing
iii) Cost
iv) Cultural sensitivity

a. i   b. iv   c. ii   d. iii

QUESTION 5

Omar asked his classmates the following question.
"Don't you think apartment buildings should allow residents to have cats?"
Which of the following might be a problem with his survey?
i)   Timing
ii) Bias
iii) Privacy
iv) Cost

a. i   b. iv   c. ii   d. iii

QUESTION 6

Give 3 examples of data collection that might be affected by timing. Justify your answers.

2. **Select and defend the choice of using either a population or a sample of a population to answer a question.**

- Identify whether a given situation represents the use of a sample or a population.

Simple Random Sampling – this type of sampling involves each member of the population having an equal chance of being selected.

Systematic or Interval Sampling – this sampling involves starting randomly and then selecting every n^{th} member from then onwards

Cluster Sampling - total population is divided into groups or clusters and every member of the randomly selected group is chosen.

Self-selected sampling – this sample only includes only members who are interested and volunteer to be part of a survey.

Convenience Sampling – this can be known as grab or opportunity sampling. It involves the sample being selected from a population which is close to hand.

Stratified Random Sampling – this includes randomly selecting members from each group of the population.

QUESTION 1

A company makes granola bars in batches of 1200. The quality control inspector tests 5 randomly selected bars from each batch. Which sampling method does the inspector use?

a. Convenience sampling
b. Simple random sampling
c. Cluster sampling
d. Stratified random sampling

A town council wants to know the public's opinion about increasing taxes to pay for more housing for the homeless. They hire people to conduct door-to-door interviews in randomly selected areas of town. Which sampling method did the town council use?

a. Self-selected sampling
b. Simple random sampling
c. Systematic sampling
d. Cluster sampling

Statistics are numbers that describe data (the information that is collected to look at).

We use statistics to make information more meaningful in everyday life and to understand different trends (patterns) that we see. For example, Stats Canada uses the information about Canadian citizens to see rises and falls in immigration, births, deaths, etc.

The information is not meaningful just as raw data (numbers that have not been looked at); it becomes meaningful and useful when it is analyzed.

Before we can analyze data though, we need to **collect** it.

Population – a collection of people you will get the information from when collecting data

Census - is the procedure of obtaining and recording information about the members of a given population. It is often done door-to-door.

Sample – is a subset or small portion of the population from which the data is being collected from. The sample should be a good representation the entire population.

Valid Conclusion – will result if the data is collected from a representative sample of the population

A cosmetics company wants to determine which eye shadow colours are preferred by the readers of a certain fashion magazine. What is the population they are interested in surveying?
i)   People who purchase the magazine
ii) People who wear eye shadow
iii) People who read the magazine
iv) Fashion experts featured in the magazine
a.   i   b.   ii   c.   iv   d.   iii

QUESTION 4

A city council wants to know if residents think there is a need for more library facilities.
What is the population they are interested in surveying?
i)   Students who use the libraries
ii) City residents
iii) People who use the libraries
iv) People who work at the libraries
a.   ii   b.   iii   c.   i   d.   iv

QUESTION 5

Paul wants to conduct a survey to find out at what age most people in his school learned to swim. There are 767 students at his school and he does not have time to ask them all, so he must select a sample population to survey.

Which of the below methods would be the best way for him to select his sample population?

○ A) Surveying members of the school swim team
○ B) Asking Grade 1 students
○ C) Randomly selecting girls
○ D) Questioning 20 randomly selected students in the hallway

QUESTION 6

A travel agency wishes to conduct a survey to see what percentage of Canadians go on holidays each year. To get the best representative sample of the Canadian population for the survey, they should select people

○ A) that work downtown
○ B) who are at the airport
○ C) from the phonebook at random
○ D) who are in hotel lobbies

QUESTION 7

The owners of a chain of fast food restaurants want to know if customers are satisfied with the restaurant chain. They set up a Web site where customers can enter a code from their receipt and then rate the restaurant.
Are the data collected from a sample or a population?

- **Provide an example of a situation in which a population may be used to answer a question, and justify the choice.**

QUESTION 1

A nutritionist wants to find out what grade 9 students in Saskatoon normally eat for breakfast. She randomly selects a grade 9 class from each school in the city and interviews all the students in the class. Will the selected sample represent the population?

YES

QUESTION 2

An airline manager wants to assess customer satisfaction at check-in. She decides to survey every 30th person who checks in for one week. Will the selected sample represent the population?

YES

- **Provide an example of a question where a limitation precludes the use of a population; and describe the limitation, e.g., too costly, not enough time, limited resources.**

QUESTION 1

Ava wants to determine what kind of pizza her friends on the volleyball team like the most. Which of the surveying methods would cost the most?

A.	Mailing out a questionnaire to all junior high students

B.	Telephoning a sample of 30 junior high students

C.	Asking the employees at a local pizza shop about the kind of pizza that is sold the most

D.	Conducting personal interviews with a sample of 30 junior high students during recess

- **Identify and critique a given example in which a generalization from a sample of a population may or may not be valid for the population.**

QUESTION 1

A food company wants to know what people aged 15 to 25 eat for breakfast.
They interview a random sample of high school, college, and university students.
What is a potential problem with this sampling method?

In each case, do you think the conclusion is valid? Justify your answers.
a) The owner of a gift store receives a shipment of 100 figurines. Each of the first five figurines he inspects are broken. He calls the supplier to complain that all of the figurines are damaged.
b) Rachel surveyed 15 students to find out if they were vegetarians. All of the students said they were not vegetarians. Rachel concluded that no one in the school was a vegetarian.

- **Provide an example to demonstrate the significance of sample size in interpreting data.**

QUESTION 1

Which of the following samples is the **best** choice to see how many people see the eye-doctor for regular checkups?

A.   25 people at the mall

B.   25 people who wear glasses

C.   25 people in the waiting room at the eye-doctor

D.   25 of your friends

QUESTION 2

Suppose you are the principal of a high school.
You want to know where students volunteer most often.
a) What population are you interested in surveying?
b) Would you survey a sample or population? Explain.
c) If you had to use a sample, what would you do to make sure your conclusions are valid?

3. Develop and implement a project plan for the collection, display and analysis of data by:

- **formulating a question for investigation**

- **choosing a data collection method that includes social considerations**

- **selecting a population or a sample**

- **collecting the data**

- **displaying the collected data in an appropriate manner**

• **drawing conclusions to answer the question.**

- ~~Create a rubric to assess a project that includes the assessment of:~~

  • a question for investigation

  • the choice of a data collection method that includes social considerations

  • the selection of a population or a sample and the justification for the selection

  • the display of collected data

  • the conclusions to answer the question.

- ~~Develop a project plan that describes:~~

  • a question for investigation

  • the method of data collection that includes social considerations

  • the method for selecting a population or a sample

  • the methods for display and analysis of data.

- ~~Complete the project according to the plan, draw conclusions, and communicate findings to an audience.~~

- ~~Self-assess the completed project by applying the rubric.~~

Strand: Statistics and Probability (Chance and Uncertainty)

General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

4. Demonstrate an understanding of the role of probability in society.

- Provide an example from print and electronic media, e.g., newspapers, the Internet, where probability is used.

Did you ever wonder how the advertisers for Pepsi or Coke come up with their statistics? 8 out of every 10 people choose Pepsi over Coke.

Or have you ever wondered how they choose the "top 6 at 6:00" on Country 105 FM?

We use statistics to make information more meaningful in everyday life and to understand different trends (patterns) that we see. For example, Stats Canada uses the information about Canadian citizens to see rises and falls in immigration, births, deaths, etc.

The information is not meaningful just as raw data (numbers that have not been looked at); it becomes meaningful and useful when it is analyzed.

Before we can analyze data though, we need to **collect** it.

- Identify the assumptions associated with a given probability, and explain the limitations of each assumption.

- ~~Explain how a single probability can be used to support opposing positions.~~

- Explain, using examples, how decisions may be based on a combination of theoretical probability, experimental probability and subjective judgment..

Probability

Probability is the likelihood (or chance) that a random event will occur

- Probability expressed in the form of a decimal or fraction:
- If the probability is 0, than the event is unlikely to occur.
- If the probability is 1, than the event is likely to occur.
- If the probability is 0.5, than there is a 50/50 chance that the event will occur.

Experimental Probability

One way to determine the probability of an event is to do an experiment; such as tossing a coin so many times to see if it lands on heads to tails.

Example

A bag contains 10 red marbles, 8 blue marbles and 2 yellow marbles. Find the experimental probability of getting a blue marble.

Solution

Take a marble from the bag.

Record the color and return the marble.

Repeat a few times (maybe 10 times).

Count the number of times a blue marble was picked (Suppose it is 6).

The experimental probability of getting a blue marble from the bag is $\dfrac{6}{10} = \dfrac{3}{5}$

Theoretical Probability

Probability is a likelihood that an event will happen.

Theoretical Probability ~ determine the probability by using a sample space – by dividing the # of successful outcomes by the total # of possible outcomes

We can find the theoretical probability of an event using the following ratio:

$$P(event) = \frac{number \ of \ favorable \ outcomes}{total \ number \ of \ outcomes}$$

⟵ The number of times that the desired event occurs

⟵ The total number of events that can occur

Please note that this is also called the sample space.

Example

A bag contains 20 marbles. 15 of them are red and 5 of them are blue in color. Find the probability of picking a red marble.

$$P(red \ marble) = \frac{Number \ of \ red \ marbles \ in \ the \ bag}{Total \ number \ of \ marbles \ in \ the \ bag} = \frac{15}{20} = \frac{3}{4} = 0.75 = 75\%$$

QUESTIONS

1. Max buys 10 raffle tickets at the school basketball game. There are 200 tickets sold. The probability of winning is 10/200. This is an example of:

   a. experimental probability   c. subjective judgement

   b. theoretical probabillty

2. Sophie tosses a coin 75 times and finds that is lands on tails 45 out of the 75 times. This is an example of:

   a. experimental probability   c. subjective judgement

   b. theoretical probabillty

3.

According to the weather forecast, there is a 90% chance of snow, with accumulations of up to 10 cm. Andrew drives out to see his friends because he thinks the weather will not be as bad as it is forecasted to be. Is his decision based on theoretical probability, experimental probability, or subjective judgment?
   a. Subjective judgment
   b. A combination of experimental probability and subjective judgment
   c. Theoretical probability
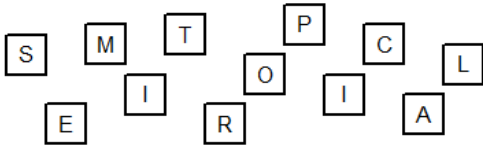   d. Experimental probability

4.

A game involves spinning this spinner.
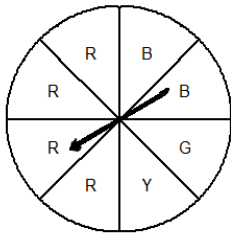
What is the probability of the pointer landing on Y?

a. $\frac{5}{8}$ b. $\frac{3}{8}$ c. $\frac{1}{8}$ d. $\frac{1}{2}$

5.

The letters below are written on pieces of paper and placed in a hat.
You draw a letter without looking.
Find the probability of drawing a consonant.

a. $\dfrac{5}{12}$ b. $\dfrac{12}{7}$ c. $\dfrac{7}{12}$ d. $\dfrac{2}{3}$

6.   If 80% of the students eating in the cafeteria are males and there are 175 students in the cafeteria , how many females are there?

    a.   140

    b.   105

    c.   35

7.   A barrel contains 30 cans of fish, all of the same size. There are: 4 salmon flakes, 13 tuna flakes, 5 chunk tuna and 8 chunk salmon. Ben picks a can of fish without looking. What is the probability that the can contains salmon?

    a.   26.7%

    b.   13.3%

    c.   40%

8.

Mr. Bell watched students purchase food at the school cafeteria during the first half hour of lunch time one day. 44 of the 80 students chose pizza. Mr. Bell concluded that 55% of the students will eat pizza on a given day.
State at least three assumptions Mr. Bell made.

ANSWERS

Strand: Shape and Space (Measurement)

Question 1

D

Question 2

4.4

Question 3

D = 40 degrees

Question 4

C – 44 degrees

Question 5

y = 68 degrees, z = 34 degrees

Question 6

x = 44 degrees

Question 7

x = 65 degrees

Question 8

D

Question 9

40.4

Question 10

8.5cm

Question 11

y = 17.0

Question 12

4

Question 13

5.3

Question 14

120

Question 15

4.5m

Strand: Shape and Space (3-D Objects and 2-D Shapes)

Question 1

A

Question 2

861cm^2

Question 3

2425cm^2

Question 4

C

Question 5

D

Question 6

1657 cm^2

Question 7

C

Question 8

C

Question 9

x=8

Question 10

a. x =33, y =55

b. 140.8cm

Strand: Shape and Space (Transformations)

Question 1

Scale Factor $= \dfrac{\text{Length of enlargement (scaled diagram)}}{\text{Length of original}}$

$90 = \dfrac{x}{0.03}$
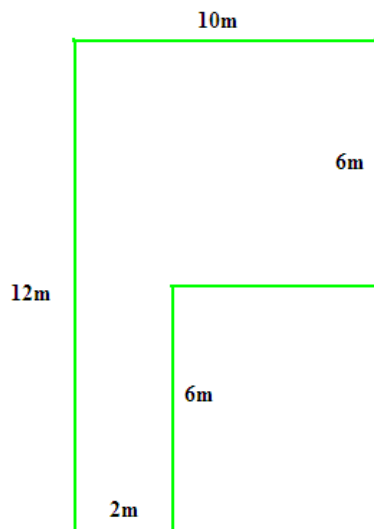
$x = (90)(0.03) = 2.7m$

$90 = \dfrac{x}{0.02}$

$x = (90)(0.02) = 1.8m$

$A = (2.7)(1.8m) = 4.86m^2$

Question 2

2/3

Question 3

Question 4

D

Question 5

C

Question 6

a.   S.F. = 1/55   1 unit = 55cm on room

b.   L   x   W

        Bed (275cm x 192.5cm)

        Couch (220cm x 110xm)

        Desk (165cm x 82.5cm)

Question 7

A

Question 8

B

Question 9

D

Question 10

C

Question 11

C

Question 12
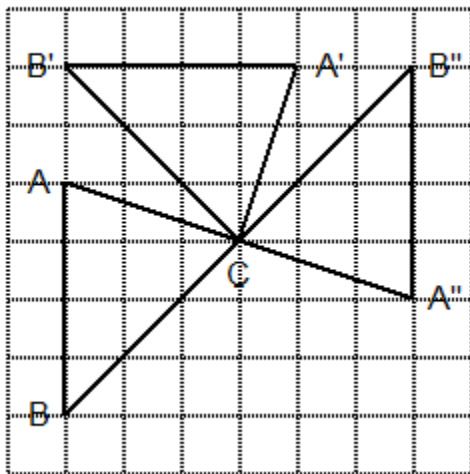
B

Question 13

iv

Question 14

C

Question 15
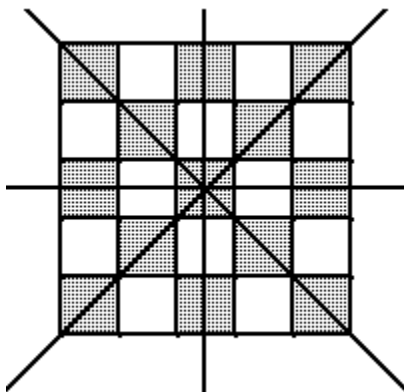
A

Question 16
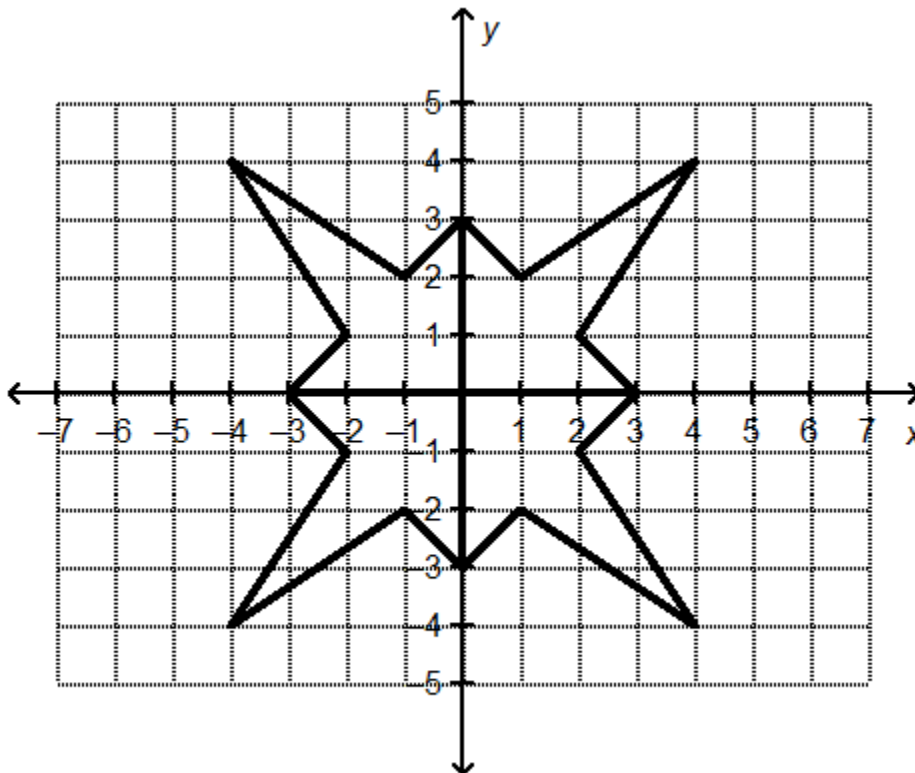

Question 17

Question 18

ANS:
Sample answers:
90° clockwise about the point (4, 4)
90° counterclockwise about the point (4, 4)
270° clockwise about the point (4, 4)
270° counterclockwise about the point (4, 4)

Question 19

The shape has four lines of symmetry.

Question 20

One line of symmetry and a reflection in the x-axis if the red line were the x-axis

Question 21

Quadrilateral B is the reflection image of quadrilateral A in the oblique line through (0, 8) and (8, 0).
Quadrilateral C is the reflection image of quadrilateral A in the vertical line through 4 on the *x*-axis.
Quadrilateral D is the reflection image of quadrilateral A in the oblique line through (0, 0) and (8, 8).
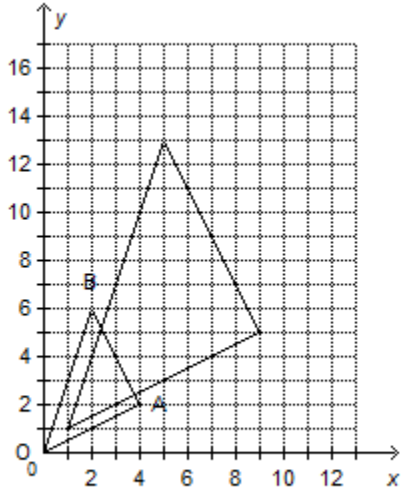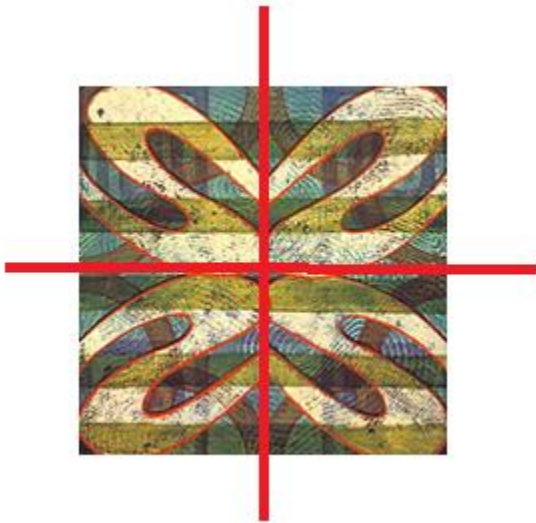
Question 22
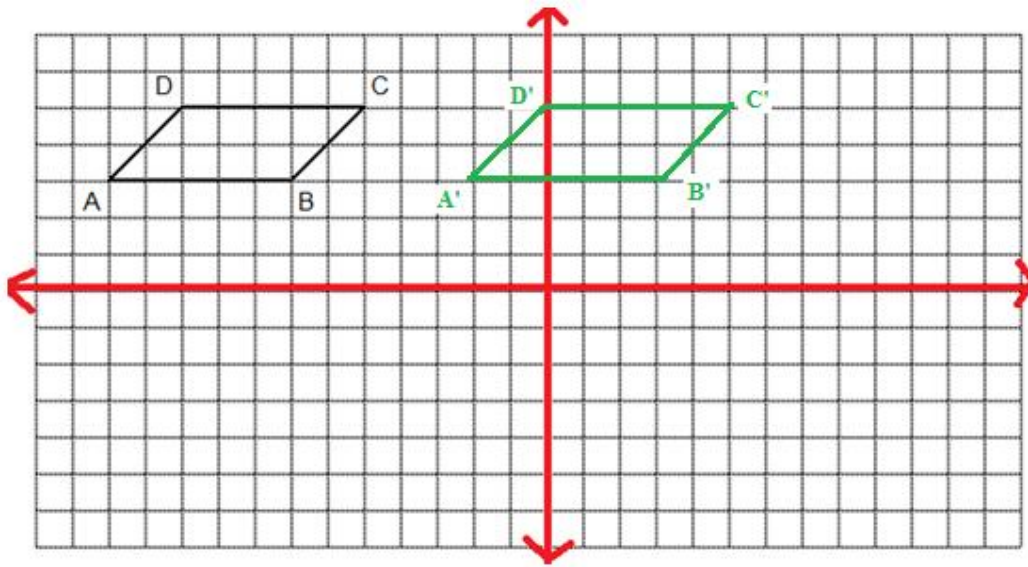
Question 23

a)

The coordinates of the vertices of the new triangle are: $(1, 1), (9, 5), (5, 13)$

Question 24

Rotational symmetry of Order ~ 4

Angle of Rotation ~ 360°/4 = 90°

ANSWERS

Strand: Statistics and Probability (Data Analysis)

General Outcome: Collect, display and analyze data to solve problems.

QUESTION 1

B (timing)

Surveying about a ice rink (typically a winter sport) in the summer.

QUESTION 2

B (cultural sensitivity)
Individual beliefs is a factor to consider

QUESTION 3

D

QUESTION 4

C

QUESTION 5

C

QUESTION 6

Answers will vary. For example:
Collecting data about teenagers' attitude toward school, outdoor sports, or cellphone regulations may be affected by timing.
Teenagers might be more likely to feel negatively about school during the first week after Winter break.
Teenagers might be more likely to feel positively about outdoor sports in May or June than in October.
Teenagers may be more likely to feel cellphone use should be restricted after watching a movie.

2. **Select and defend the choice of using either a population or a sample of a population to answer a question.**

QUESTION 1

D –samples from each group are selected

QUESTION 2

D – randomly chosen groups where all members of that group are chosen

QUESTION 3

D – people who read the magazine

QUESTION 4

A – city residents

QUESTION 5

D – Questioning 20 randomly selected students in the hallway will give Paul the best selection of the population – the other ways have too limited samples

QUESTION 6

C – From the phonebook at random - the other ways have too limited samples

QUESTION 7

Sample

- **Provide an example of a situation in which a population may be used to answer a question, and justify the choice.**

QUESTION 1

YES

QUESTION 2

YES

- **Provide an example of a question where a limitation precludes the use of a population; and describe the limitation, e.g., too costly, not enough time, limited resources.**

QUESTION 1

Ava wants to determine what kind of pizza her friends on the volleyball team like the most. Which of the surveying methods would cost the most?   A

- **Identify and critique a given example in which a generalization from a sample of a population may or may not be valid for the population.**

Not all people aged 15 to 25 attend high school, college, or university.

a) No, the conclusion is not valid. The owner probably only inspected figurines at the top of the container, or in one corner. If the figurines were damaged because something hit the container, figurines in the middle should be fine. The owner should inspect figurines in the middle of the container before calling his supplier.

b) No, the conclusion is not valid. 15 students is not a large proportion of the school's population. Also, Rachel only surveyed students, but she makes a conclusion about everyone in the school. Rachel should survey more people at the school, including teachers and staff, to make a valid conclusion.

- **Provide an example to demonstrate the significance of sample size in interpreting data.**

Which of the following samples is the **best** choice to see how many people see the eye-doctor for regular checkups? A

A.   25 people at the mall

B.   25 people who wear glasses

C.   25 people in the waiting room at the eye-doctor

D.   25 of your friends

a) The population is all the students in the school.
b) I would survey a sample. It would likely be very difficult and time-consuming to get survey responses from every student.
c) I would make sure my sample included males and females from each grade, and students in different cliques.

Strand: Statistics and Probability (Chance and Uncertainty)

General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

QUESTION 1

B

QUESTION 2

A

QUESTION 3

A

QUESTION 4

C

QUESTION 5

C

QUESTION 6

C

QUESTION 7

C

QUESTION 8

Answers will vary. For example:
Pizza is available every day.
There is enough pizza for everyone who wants it
The demand for pizza is the same throughout lunch time
The demand for pizza is the same every day.
The proportion of students who choose pizza will be the same everyday.