Mental Math Practice – Questions per Unit

UNIT 1

Perfect squares

7. Evaluate: $\sqrt{\frac{16}{25}}$
8. Find the negative square root of $\frac{81}{49}$.
9. Evaluate: $\sqrt{25} + \sqrt{36}$
10. Determine the value of $\sqrt{(9 + 4 \times 5 \times 2)}$.

7. Evaluate: $-\sqrt{625}$
8. Evaluate: $\sqrt{3^4}$
9. Evaluate: $\sqrt{152^2}$
10. Which of the following numbers are perfect squares?
    2 144 120 92 4900

7. Evaluate: $\sqrt{\frac{9}{16}}$
8. What is the negative square root of the expression $99 - 5 + 3 \times 2$?
9. Evaluate: $13 - \sqrt{144} \times 5$
10. The square root of a number is 14. What is that number?

7. The value of $\sqrt{21}$ is found between which two consecutive numbers?
8. Estimate the value of $\sqrt{30}$.
9. Find the value of $\sqrt{0.16}$.
10. The value of $\sqrt{87}$ is found between which two consecutive numbers?

7. Estimate the value of $\sqrt{9.2 \times 4.3}$ as a whole number.
8. Determine the approximate value of $\sqrt{\frac{17}{50}}$ (as a fraction).
9. The value of the negative square root of 88 is found between what two integers?
10. Find the value of $\sqrt{0.0025}$.

6. Which numbers are not perfect squares: 4, 89, 121, 256, 1000?
7. The square root of a number is 15. What is the number?
8. What is the number if the square root is 14?
9. The product of two numbers is 36. What is the product of their square roots?
10. Evaluate: $\left(\sqrt{36} - \sqrt{16}\right)^2$

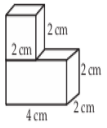
Area of composite figures

7. How many faces are there in a right rectangular prism?
8. Two cubes with 5 cm edges are glued together so that one is aligned on top of the other. What is the surface area of the glued shape?

For questions 9 and 10, a right cylinder with a 10 cm diameter sits on top of a cube with 10 cm edges (as shown below in this top view). Use $\pi \approx 3$.

9. Estimate the area that overlaps.
10. Estimate the area that does not overlap.

9. Determine the area of the overlap.
10. Determine the surface area of the front face of the shape.



UNIT 2

Powers / Exponents of 0 and 1 / Law of exponents

7. $(6^3)(6^2)$
8. $\frac{7^{12}}{7^4}$
9. $(9^2)^3$
10. $(12^4)^0$

7. Write the following in repeated multiplication form: 2^5
8. Evaluate: 3^3
9. Evaluate: 1^8
10. Evaluate: $(-3)^0$

7. Simplify the expression and write it in exponent form: $(13^2 \times 13^7)^4$
8. Simplify: $\left(\frac{2}{3}\right)^3$
9. Simplify: $4^2 \times 5^2$
10. Simplify: $\frac{3^2 + 8^0}{5^2}$

7. Write the following multiplication in exponent form: $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$
8. Which is larger: 3^4 or 4^3?
9. Find the difference: $2^6 - 2^3$
10. Evaluate: $5^2 + 4^0$

7. Evaluate: $2(3)^2$
8. Evaluate: $50 - 2^5$
9. Evaluate: -4^2
10. Evaluate: $1 + 2 \times 3 + 4$

7. $3^4 \times 3^5$
8. $\frac{5^{13}}{5^7}$
9. $(4^3)^2$
10. $(5^3)(5^0)$

5. $(-2)^3$
6. $-(3)^4$
7. $(-4)(-4)(-4)$
8. $\frac{4^0 \times 2^3}{2}$
9. $\frac{3^2 + 2^0}{5}$
10. $\frac{8^2}{4^3}$

6. $3 + 2^3$
7. $(7^0 + 3^2)^2$
8. $\frac{4 + 2^3}{6}$
9. $(-3)(4^2 + 2^0)$
10. $\frac{2^5}{4^2} - 5^0$

UNIT 3

Ordering positive and negative numbers / Fractions to decimals / Operations with decimals / Operations with fractions / Operations with integers / BEDMAS

7. Place the following in ascending order: $-0.2, -\frac{4}{7}, -0.8, -\frac{1}{6}$
8. Multiply: $7^0 \times 5^2$
9. Write $\frac{7}{20}$ in decimal form.
10. Write 0.56 as a reduced fraction.

7. Find the value of the decimal that corresponds to $0.7 + \frac{3}{5}$.
8. Put the following in ascending order: $\frac{3}{4}, \frac{2}{5}, \frac{4}{6}$
9. The fraction $\frac{37}{8}$ is found between which two consecutive whole numbers?
10. Find the fraction that corresponds to $0.8 + \frac{2}{5}$.

7. Evaluate: $(5^2 - 2^4) \times 3$
8. Evaluate: $(12 - 3 \times 3) \times 5$
9. Evaluate: $10 + (2 \times 3 - 15)^0$
10. In an enclosure, there are 11 rabbits and 3 ducks. Calculate the number of legs.

UNIT 4

Patterns in relations / Determining the equation (relation) from input/output table / Graphing linear relations of the –x and –y type

7. Find the next number in the sequence: 1, 1, 2, 3, 5, 8, 13, ___?

8. Find the next number in the following sequence:
100, 400, 900, 1600, 2500, 3600, ___

9. A rectangle has a length of $2x + 1$ units. If you triple the length of the rectangle, write an expression representing the new length.

10. Paul is now 7 years old. Write an equation that represents his age x years from now.

7. Write the mathematical statement corresponding to the following written statement: "The sum of two consecutive integers is equal to negative eleven."

8. Complete this pattern: $-1 \rightarrow 1, 2 \rightarrow 4, 3 \rightarrow 5, 4 \rightarrow 6, x \rightarrow$ ___

9. Your current age is x years. Write an expression to represent your age 12 years ago.

10. Find the next number in the sequence: 2, –10, 50, –250, ___

7. Find the missing number in the following sequence:
1, 2, 4, 8, ___, 32

8. Write the mathematical statement corresponding to:
"Eight less than two times a number is equal to four."

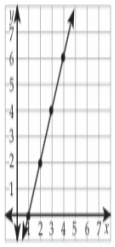
9. Complete this pattern: $1 \rightarrow 2, 2 \rightarrow 4, 3 \rightarrow 9, 4 \rightarrow 16, a \rightarrow$ ___

10. Find the missing number in the following sequence:
0, 3, 8, 15, 24, 35, 48, ___

8. Given, $y = 3x - 1$, find the value of y when $x = 10$.

9. In the graph shown, what is the value of x when $y = 4$?

10. In the graph shown, what is the value of y when $x = 3.5$?



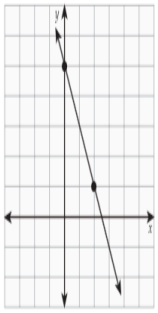
The graph below shows a line that passes through the points (0, 5) and (2, 1).

7. What is the value of x when $y = 0$?

8. What is the value of y when $x = 1$?

9. Determine the value of x when $y = 7$.

10. Determine the value of y when $x = 4$.



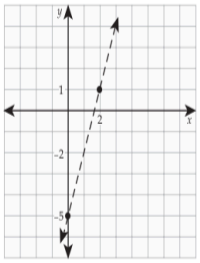
3. What is x when y is equal to 1?

4. How much does the value of y increase when the value of x increases by 1?

5. What is y when x is equal to 3?

6. What is y when x equals 0?

7. What is x when y is equal to –2?



8. Saad is 5 years younger than three times the age of Natasha. What is the age of Saad if Natasha is 3 years old?

9. Complete the pattern: 7, 14, 21, ___

10. You can represent the pattern 9, 16, 25, 36, . . ., using a linear equation? True or false?

UNIT 6

Solving equations / Inverse operations / Understanding inequalities / Solving inequalities / Parts of an expression or equation

What name do you give to each of the parts of the expression $4x^2 + 8$?

7. 4
8. x
9. 2
10. 8

Write a linear inequality to represent the following.

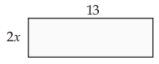
9. Five chocolate bars cost more than $12 and the cost of each bar is unknown.
10. Jean ran less than 18 km in 3 hours and his speed is unknown.

7. Solve: $3x = 12$
8. Solve: $4x - 2 = 18$
9. Solve: $5x - 6 = 4$
10. Solve: $2(x - 3) = 8$

7. Is $x = -3$ the solution to the equation $2x + 6 = 12$? Justify your answer.
8. Solve: $\frac{x}{8} = 12$
9. Solve: $\frac{24}{x} = 6$
10. Solve: $\frac{3}{x} = 6$

7. Solve: $3x = 10 + x$
8. Solve: $-2x = -8 - 3 + 5$
9. What is the opposite of adding $\frac{1}{4}$?
10. Solve: $2(x + 2) = 18$

7. Solve: $0.7x + 1.8x = 10$
8. Solve: $\frac{x}{3} + 5 = 20$
9. Find the value of x if the perimeter of the rectangle shown measures 46 units.



10. Is $x = 2$ the solution for the equation $2(x + 3) + 5x = 3x + 14$? Justify your answer.

7. $2x \geq 4$
8. $-3x \leq 15$
9. $3 + 2x < x + 5$
10. $5 - 5x > 10 - 4x$

7. When dividing by a negative number on both sides of a linear inequality, what happens to the inequality symbol?
8. You have $5 and want to spend some of it to buy x bars of chocolate, which cost 0.67¢ each. Write an inequality that represents this.
9. If $x = 2$, then $3x > 2x + 3$. True or false?
10. If $x = -2$, then $-2x + 5 > 5$. True or false?

7. In the solution to an inequality, explain the difference between $x > 5$ and $x \geq 5$.
8. You have at most $110 to spend on a number of pizzas that cost $12 each. The delivery charge is $7. Write an inequality that models this situation.
9. Determine the maximum number of pizzas you could buy and have delivered as described in question 8.
10. Is $x = 1$ the solution to the equation $3(x + 4) + 2x < 4x + 9$? Justify your answer.

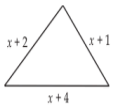
UNIT 5

Polynomials: terms, variable, degree / Monomials, binomials, trinomials / Adding and subtracting polynomials / Dividing by a monomial / Multiplying by constant, monomial

Respond to questions 5 to 10 concerning the polynomial $3x^2 - 2y^2 + 9$.

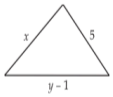
5. What are the two variables in the polynomial?
6. What is the coefficient of the variable y?
7. How many terms does the polynomial have?
8. What is the exponent of the variable x?
9. What is the value of the constant?
10. What is the coefficient of the variable x?

7. If x is your current age, write an expression for your age in 10 years.
8. One-quarter of a number equals 3. Express this in an equation.
9. Write an expression to describe the perimeter of the triangle shown on the right.



10. How many terms are in the expression $4x^3 - 8x + 6y$?

7. Identify the constant in the expression $8x - 16 + 3y$.
8. Write an equivalent expression to $\frac{2x+1}{2}$.
9. Identify the like-term(s) to $3x$ amongst the following terms:
   $-2x$ $6x^2$ $3y$
10. Write an expression to describe the perimeter of the triangle shown on the right.



7. Simplify: $3x - 7x$
8. Simplify: $x + 3x + 6x$
9. Simplify: $4x + 5x - 2x - x$
10. Which term in the polynomial, $3x - 5x^2 + 6$, has the exponent with the highest degree?

7. Simplify: $(2x + 6) - (5x - 4)$
8. Simplify: $4x + 5 + 8x^2 + 3x - 4 - 10x^2$
9. Simplify: $3x^2 + 3x + 3 - (2x^2 + 4x + 2)$
10. Find the binomial that is missing: $(3x + 1) + (\_\_\_\_\_) = 2x + 3$

7. Simplify: $(3x^2 + 2x + 6) - (5x^2 - 3x + 12)$
8. $5x^2 - 4$ is equivalent to $(3x^2 + 4x - 7) - (-2x^2 + 4x - 3)$. True or false?
9. Which expression is equivalent to $\frac{-6x^2 - 4x - 12}{-2}$?
   a) $3x^2 - 4x - 12$
   b) $3x^2 + 2x + 6$
   c) $3x^2 - 2x - 6$
10. Simplify: $3x^2 + 3x + 3 + 2x^2 + 4x + 2$

7. Find the product of $8x$ and $3x$.
8. Simplify: $(4ab)(3ab)$
9. Simplify: $\frac{24x^2y}{8x}$
10. Simplify: $(-5y)(-8x^2y)$

7. Simplify: $2(x + 2y)$
8. Simplify: $3x(2x - 4y + 1)$
9. Simplify: $-5(8 + 2)$
10. Simplify: $-5x(z^2 - 4x + 3)$

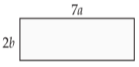
For questions 7 and 8, find the value of the polynomials knowing that $x = 3$ and $y = 2$.

7. $x^2 + y^2$

8. $-x - 3y$

9. Write an expression equivalent to $-(x - 3)$.

10. Express the area of the following rectangle in terms of a and b.



Divide the following equations for questions 7 to 9.

7. $\frac{8x^2}{2x}$

8. $(5xy) \div (5y)$

9. $(-12x^2) \div (4x)$

10. The area of a rectangle is $72t^2$ and its width is $12t$. What is its length?

Simplify the following polynomials for questions 9 and 10.

9. $(4x - 2) + (8x + 5)$

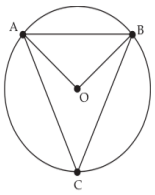
10. $(5m - 3) - (2m - 7)$

UNIT 8

Radius / Diameter / Chord / Minor arc / Major arc / Inscribed angle / Central angle

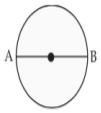
Use the circle below to answer questions 7 to 10.

7. Name a central angle.
8. Name an inscribed angle of arc AB.
9. Name a chord.
10. Name a minor arc.



7. What is the measure of a right angle?
8. The measure of a central angle is _____ the measure of an inscribed angle that is subtended by the same arc.
9. All inscribed angles that are subtended by the same arc are _____.
10. What is the measure of the angle formed between a tangent line and a radius segment at the point of tangency?

7. What is the measure of an inscribed angle subtended by a semicircle?
8. Determine the radius of the following circle if AB = 7.5 cm.



9. The measure of an inscribed angle is _____ the measure of the central angle subtended by the same arc.
10. A central angle measures 64°. What is the measure of an inscribed angle subtended by the same arc?

7. The arc of a circle that is exactly half of the circle is called _____.
8. The circumference of a circle is 54 cm. What is the length of the semicircle arc?
9. What is the measure of an inscribed angle subtended by a semicircle?
10. The point on the circle where a radius segment and tangent line meet is called _____.

7. In the circle with centre O, ∠ACB measures 40°. What does ∠AOB measure?

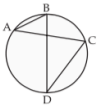
8. An arc that measures less than half of a circle is called a _____ arc.
9. What term is used to describe line segment $\overline{AB}$?

10. If ∠AOB is 42°, what is the measure of ∠ACB?

7. The line perpendicular to a radius segment at the point of tangency is called _____.
8. Write the measure of angle m.

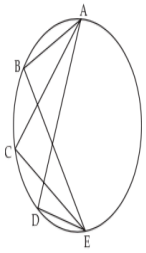
9. Write the measure of angle x.

10. In the circle shown, ∠ABD measures 63°. Name the other angle that must also measure 63°.



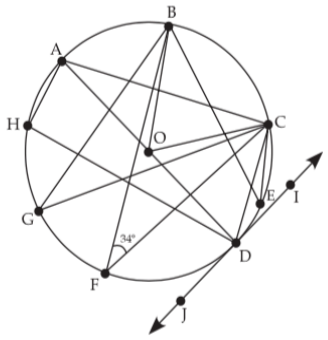
For questions 8 to 10, use the following figure.

8. If ∠ABE = 85°, what other angle measures do you know?
9. What name is given to angles such as ∠ABE, ∠ACE, and ∠ADE?
10. Complete the following sentence. ∠ABE and ∠ACE are congruent because they are subtended by _____.



Given the circle with centre O, diameter AD, tangent IJ, tangent point D, and the measure ∠BFC = 34°, determine the measure of:

1. ∠ADJ
2. ∠BGC
3. ∠BEC
4. ∠BOC
5. ∠ACD
6. ∠AHD



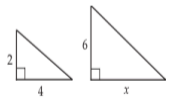
Using the diagram above, give an example of

7. an inscribed angle of arc AH.
8. a central angle involving point B.
9. a radius.
10. ∠AHD is subtended by an arc. What is the name of the arc?

UNIT 7

Scale factor / Reduction / Enlargements / Ratio / Proportionality / Line of symmetry / Vertical and horizontal symmetry / Rotational symmetry / Order of rotational symmetry / Degree of rotational symmetry / Ordered pairs / Translations / Rotations / Reflections

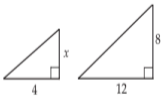
7. Two similar triangles are shown. Find the value of x.



8. If two triangles are similar, the measurements of their corresponding sides are equal. True or false?

9. Complete the sentence. If two triangles are similar, the measures of their corresponding angles are _____.

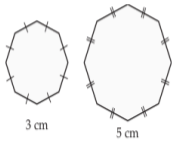
10. Two similar triangles are shown. Find the value of x.



7. A regular octagon with 5 cm sides is similar to a regular octagon with 10 cm sides. True or false?

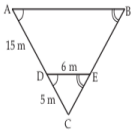
8. A regular pentagon with 2 cm sides is similar to a regular hexagon with 2 cm sides. True or false?

9. Are these two polygons similar? Explain.

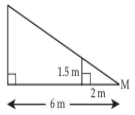


10. Solve for x in the proportion: $\frac{x}{8\text{ cm}} = \frac{3\text{ cm}}{2\text{ cm}}$

7. Find the length of side AB.



8. You measure 1.5 m in height and your shadow is 2 m long. A tree's shadow is 6 m long. Find the height of the tree.



9. Any two squares are similar. True or false?

Calculate the missing value for questions 5, 6, and 7.

5. $\frac{x}{4} = \frac{6}{24}$

6. $\frac{2}{x} = \frac{8}{12}$

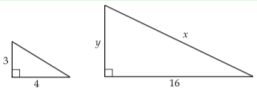
7. $\frac{5}{3} = \frac{25}{x}$

8. Why are all rectangles not similar?

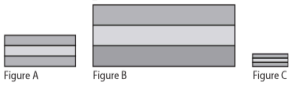
Use the two similar triangles shown for questions 9 and 10 to evaluate y and x.

9. y

10. x



Use Figures A, B, and C for questions 5 to 8.



5. Estimate the scale factor used to transform Figure A to Figure B.

6. What is the scale factor used to transform Figure B to Figure A?

7. Estimate the scale factor to transform Figure A to Figure C.

8. Estimate the scale factor used to transform Figure C to Figure B.

For questions 9 and 10, four identical squares can be placed in a large square.

9. What is the scale factor used to transform a small square to the large square?

10. If one side of the large square measures 20 cm, what is the measure of a side of a small square?

7. A square garden with a perimeter of 24 m is drawn on a scale of 1:300. What is the perimeter of the drawing of the garden?

8. On a coordinate plane, the vertex of a polygon is drawn at (−2, 6). What are the coordinates of the vertex if the drawing is enlarged by a factor of 2?

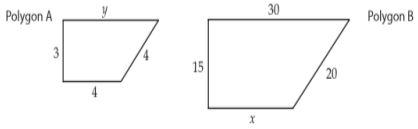
9. A pentagon is reproduced with a scale of 3:2. If one side of the pentagon is 6 cm, what is the measure of the corresponding side of the reproduced pentagon?

10. An equilateral triangle with sides equal to 22 cm is drawn so that its sides measure 11 cm. What scale factor was used?

The vertices of a geometric figure are D(0, 0), E(−2, 4), F(−2, −2), and G(6, 2). Use these coordinates to answer questions 7 to 10.

7. What are the coordinates for vertices D and E if the figure is reproduced on a scale of 1:2?
8. What are the coordinates for F and G if the figure is expanded by a factor of 3?
9. What scale is used if point E is reproduced with coordinates (−8, 16)?
10. Describe the relationship between the size of the original and the new figure described in question 9.

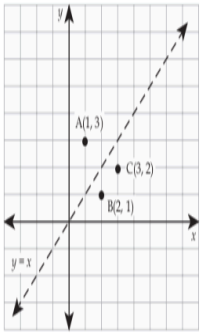
To answer questions 7 to 10, use the diagrams of the similar polygons shown below.



7. What scale is used if Polygon B is transformed to become Polygon A?
8. What scale is used if Polygon A is transformed to become Polygon B?
9. Find the value of x.
10. Find the value of y

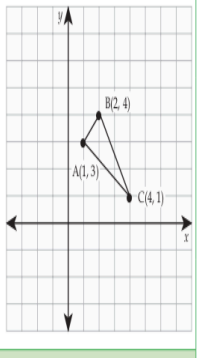
For questions 7 to 10, determine the coordinates for the requested point after the given transformation. Use the diagram shown below.

7. Point A: Reflection over the x-axis.
8. Point A: Reflection over the y-axis.
9. Point B: Reflection over the y-axis.
10. Point C: Reflection over the line $y = x$.



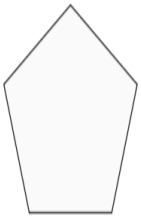
What are the coordinates of the given point after the requested rotation with respect to the origin? Use the diagram below.

7. Point A: 90° clockwise
8. Point B: 180°
9. Point C: 90° counter-clockwise
10. Point A: 360°



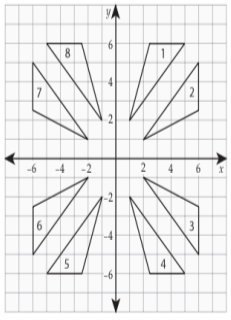
Use the regular pentagon shown below for questions 7 to 9. Determine

7. the number of lines of symmetry.
8. the order of rotation.
9. the angle of rotation.
10. Among the following letters of the alphabet, F, A, T, and X, which have no lines of symmetry?



Using the diagram below, describe the transformations that allow Triangle 1 to be moved to the position of:

7. Triangle 3
8. Triangle 4
9. Triangle 5
10. Triangle 8



UNIT 9

Probability / Theoretical probability / Experimental probability / Subjective judgement / Sample / Census / Population / Assumptions / Bias / Cultural sensitivity / Ethics / Use of language / Timing / Time / Simple random sampling / Interval sampling / Cluster sampling / Self-selected sampling / Convenience sampling / Stratified random sampling

7. The part of a population that represents the whole population is called _____.
8. A collection of data received from an entire population is called _____.
9. If each member of a population has an equal chance of being chosen from a sample, the sample is _____.
10. A factor that can prevent a sample from representing a population is called _____.

7. If you decide to interview 10% of 35 000 people, how many people will you interview?

Name three effects that may be potential problems for data collection.

8. _____
9. _____
10. _____

7. Name two factors that may cause a surveyor to use a sample rather than a population.
8. To determine students' favourite course, a fine arts class was surveyed and 90% of the students indicated that art was their favourite course. What is a factor that may influence the data?
9. Did question 8 use a sample or a population?
10. In Ontario, 35% of secondary students are vegetarians. What population is the focus of the survey?

7. Why is a census **not** done every year?
8. Veronica asks questions of random people she meets at the mall. Are these people a sample or a population?
9. Name a disadvantage of Veronica's questioning technique.
10. If Veronica poses her questions only to teenagers, what problems might she have with the data?

For each statement, identify a factor that could influence the collection of data.

7. The person does not understand what is required.
8. The person must answer all the questions.
9. The person must answer questions at noon exactly.
10. The question implies a preference for a certain product.

Jason, a member of the Graduation Committee, asked every third student who entered the cafeteria the following question, "What should be the colour of the cafeteria walls?"

7. Identify the population.
8. Identify the sample.
9. Identify the sampling technique.
10. The sampling technique is valid. True or false?

7. Write the probability of rolling a 2 or a 5 with a normal, six-sided die.

For questions 8 to 10, use the statement, "Out of the fifty cars parked in the parking lot, twenty are white."

8. What is the probability of a car on the road being white?
9. Is it a theoretical probability or an experimental probability?
10. What percent of cars in the parking lot are not white?

The kids from a community centre choose either soccer or baseball. Here are the results of their registrations.

	Soccer	Baseball
Girls	15	35
Boys	30	20

7. How many kids are registered in total from the community centre?
8. What is the theoretical probability of a random soccer registration being a girl?
9. What is the experimental probability of a community centre girl playing soccer?
10. What is the experimental probability of a community centre kid playing soccer?

7. When tossing a coin, what is the probability of it showing heads?

8. What is the probability of rolling an even number with a normal, six-sided die?

9. What is the probability of rolling a 3 with a normal, six-sided die?

10. If 70 people have green eyes out of a group of 200, what is the probability of choosing a person with green eyes from the group?

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10. What is the experimental probability of a community centre kid playing soccer?

There are three students running for student council president in an election: Kyle, Scott, and Laura. If 300 students voted and 40% chose Kyle, 30% chose Scott, and the rest chose Laura, then

7. what is the theoretical probability of choosing Scott if votes are random?

8. how many students chose Laura?

9. how many students did not choose Kyle?

10. what is the experimental probability that a student chose Scott?

Identify the factor that would influence the results of data collection for questions 1 to 10.

1. The person must give their phone number.

2. The person must answer questions before 1 p.m.

3. The question demonstrates a preference for the product.

4. The sample is not representative of the population.

5. The person does not understand the questions.

6. The question refers to religion.

7. The question asks for judgment on a particular person.

8. A telephone survey takes more than 45 minutes.

9. The survey focuses on luxury cars.

10. The person must indicate in what country they were born.

PERCENTAGE / PERIMETER / UNIT CONVERSION

1. One-quarter of 20 students from your gym class did not have their gym shoes in the last class. What percentage of students does this represent?

2. What is the perimeter of a rectangular lot that measures 60 m by 200 m?

4. Calculate a tip of 10% on a bill of $64.40?

5. How many millimetres are equal to 32.6 cm?

6. One day, Jonah painted $\frac{1}{4}$ of his kitchen. The next day, he painted another quarter of his kitchen. What fraction of his kitchen still needs to be painted?

Write an expression for the perimeter for questions 6 to 8.

6. A rectangle that has a length of $5d + 2$ and a width of $3d - 1$.

7. The three sides of a triangle are w, $3w + 4$, and $4w - 2$.

8. The side of a square is $5x + 3$.