

Meaning, Order, and Distance

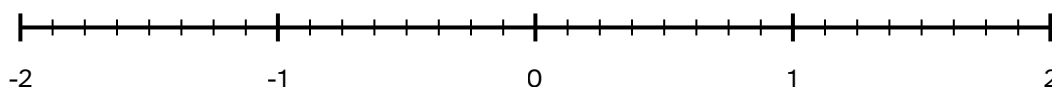
Name _____

Block _____

Date _____

QUESTION 1

The number line below is divided into eighths.



Draw a copy of the line and place these four numbers on it.

$\frac{5}{8}$	1.75	$-1\frac{3}{8}$	-0.25
---------------	------	-----------------	-------

Then state which of the four sits closest to zero and which sits farthest from zero.

QUESTION 2

Put these numbers in order from least to greatest.

$-\frac{1}{2}$	-0.6	0	$-\frac{5}{8}$
----------------	------	---	----------------

Two of them sit close together. Explain how you decided which of those two comes first.

QUESTION 3

Being greater and being farther from zero are not the same thing.

- a) Which is greater, $-\frac{7}{10}$ or $\frac{3}{5}$?
- b) Which of the two is farther from zero?
- c) Sam says, "If a is greater than b , then a is farther from zero." Give an example showing Sam is wrong, and name what Sam has confused.

QUESTION 4

Find two rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$.

Priya says there are exactly three numbers between them. Explain why she is wrong.

QUESTION 5

Between which two consecutive integers does $-\frac{17}{5}$ lie? Explain how the number line tells you.

QUESTION 6

The table shows three temperature readings taken on one day.

Time	6:00 a.m.	Noon	9:00 p.m.
Temperature	-3.5°C	$2\frac{1}{4}^{\circ}\text{C}$	-1.75°C

- Order the three readings from coldest to warmest.
- How much warmer was noon than 6:00 a.m.?
- A fourth reading at 3:00 p.m. was halfway between the noon and 9:00 p.m. readings. Find it.

QUESTION 7

A number sits 2.5 units from zero. Give every value it could have, and say how the line makes that clear.

QUESTION 8

Marek says the number halfway between two numbers is always closer to zero than both of them.

- Find the number halfway between $-\frac{3}{4}$ and $\frac{1}{4}$.
- Decide whether Marek is right. Use your answer to part a, then test his claim again with a pair of numbers that are both positive.

Adding and Subtracting Rational Numbers

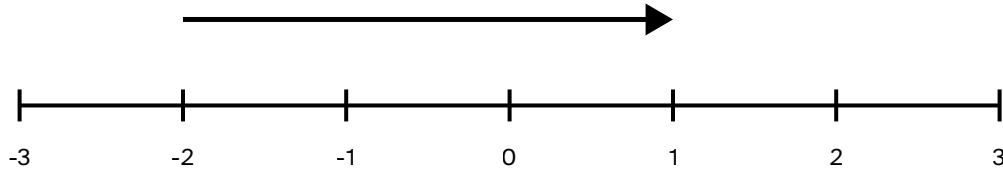
Name _____

Block _____

Date _____

QUESTION 1

The arrow represents $-2 + 3$. It starts at -2 and moves 3 units right to 1.



On the same number line, draw a straight arrow to represent $-1 + 4$. Write the equation with its result.

QUESTION 2

$2 - (-3) = 5$. Use a number line or words to explain why subtracting a negative number can make the result greater.

QUESTION 3

Calculate $-3.6 + 5.25$. Use the signs to check whether your result should be positive or negative.

QUESTION 4

Calculate $-\frac{5}{12} + \frac{7}{18}$. Use the smallest common denominator you can find.

QUESTION 5

Compare the two methods for $-2.75 + 1.8$.

Method A**Method B**

$$-(2.75 - 1.8)$$

$$-2.75 + 2 - 0.2$$

Complete both methods and check that they agree. Which method makes the signs clearer to you, and why?

QUESTION 6

Calculate $\frac{7}{8} - 1\frac{1}{4}$.

QUESTION 7

Arjun wrote:

$$-\frac{2}{3} - \frac{5}{8} = -\frac{2}{3} + \frac{5}{8} = -\frac{1}{24}$$

Identify Arjun's first mistake. Explain why that step is wrong, then repair the calculation.

QUESTION 8

A hiker starts 125m above a trail marker and then changes elevation three times.

Stage	Start	First change	Second change	Third change
Signed amount	+125m	-187.5m	$+42\frac{3}{4}$ m	-16.25m

- Write one expression for the hiker's final position.
- Calculate the final position and state whether the hiker is above or below the marker.
- Explain how the sign of your result checks your conclusion.

QUESTION 9

Rina says, "If the sum of two rational numbers is negative, both numbers must be negative."

- Give a counterexample using one positive number and one negative number.
- When two numbers have opposite signs, what must be true for their sum to be negative?

Multiplying and Dividing Rational Numbers

Name

Block

Date

QUESTION 1



Predict the sign of $-8\left(-1\frac{1}{2}\right)$. Then calculate it.

QUESTION 2

Complete the last two products in the pattern.

Expression	$3(-2)$	$2(-2)$	$1(-2)$	$0(-2)$	$-1(-2)$	$-2(-2)$
Product	-6	-4	-2	0		

QUESTION 3

Calculate $(-4.2)(-0.5)$.

QUESTION 4

Calculate $-\frac{7}{12} \left(\frac{18}{35} \right)$. Simplify before multiplying.

QUESTION 5

Calculate $\frac{\frac{5}{6}}{-\frac{10}{9}}$.

QUESTION 6

Sofia wrote:

$$\left| \frac{-\frac{3}{5}}{\frac{6}{7}} = -\frac{3}{5} \left(\frac{6}{7} \right) = -\frac{18}{35} \right.$$

Find Sofia's first mistake and fix the calculation.

QUESTION 7

Solve $-\frac{3}{5}x = \frac{9}{10}$.

QUESTION 8

A chamber cools by 2.5°C every $\frac{3}{4}$ hour. It starts at 18°C . What is its temperature after 2.25 hours?

QUESTION 9

Mateo says, "Dividing by a positive number between 0 and 1 always makes the result greater."

$$\frac{-6}{\frac{1}{2}}$$

- a) Calculate the quotient.
- b) Decide whether Mateo is right. Replace his claim with one that works for both positive and negative starting values.

Order of Operations and Strategy

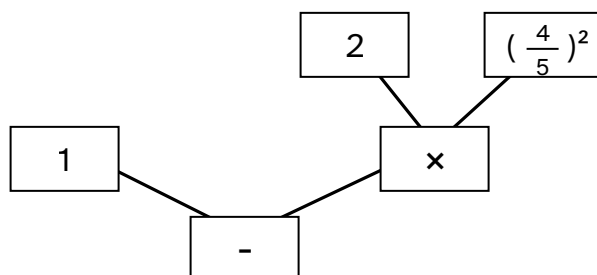
Name _____

Block _____

Date _____

QUESTION 1

The tree shows the order for $1 - 2(\frac{4}{5})^2$.



Use the tree to calculate the exact value.

QUESTION 2

Calculate $\frac{-\frac{3}{4}}{\frac{1}{5}} + \left(-\frac{1}{3}\right)\left(-\frac{5}{2}\right)$.

QUESTION 3

Calculate $(-3)^2$ and -3^2 . Why are the answers different?

QUESTION 4

Calculate $2 - 3(-4)$.

QUESTION 5

Calculate $\frac{3}{4} - \left[\frac{1}{2} - \left(-\frac{1}{8} \right) \right]$.

QUESTION 6

Leo wrote:

$$-2^2 + 3(-2) = 4 - 6 = -2$$

Find Leo's first mistake and give the correct value.

QUESTION 7

Calculate $\frac{\left[\frac{1}{2} - \left(-\frac{3}{4}\right)\right]}{\frac{5}{8}}.$

QUESTION 8

A marker is 12.5m above zero. A worker moves down 4.75m three times, then up $1\frac{1}{8}$ m twice. Find the final position.

QUESTION 9

A room starts at 12°C and cools by 3°C each hour for 5 hours.

Ava writes $12 - 3(5)$. Ben writes $(12 - 3)5$.

- a) Choose the expression that models the situation and find the final temperature.
- b) Explain what Ben's brackets make his expression do.

What Exponents Represent

Name

Block

Date

QUESTION 1

One student says 5^4 means 5×4 . Another says it means four factors of 5. Who is correct? Write the repeated multiplication.

QUESTION 2

In 7^3 , name the base and exponent. What does the exponent tell you to do?

QUESTION 3

Without a calculator, decide whether 3^4 or 4^3 is greater. Explain how you know.

QUESTION 4

Calculate 6^3 .

QUESTION 5

Complete the table.

n	1	2	3	4	5
n^2					
n^3					

QUESTION 6

Show that 2^6 and 4^3 have the same value.

QUESTION 7

Jules wrote $2^5 = 2 \times 5 = 10$. Find the mistake and give the correct value.

QUESTION 8

A display has 2^4 lights in each row and 2^4 rows. How many lights are there?

QUESTION 9

Amir says, "Doubling the base only doubles the value of a power."

- a) Compare 6^4 with twice 3^4 .
- b) Explain why doubling the base has a larger effect when the exponent is 4.

Product and Quotient Laws

Name _____

Block _____

Date _____

QUESTION 1

Follow the repeated factors, then compress each product into one power.

Expression**Repeated factors****One power**

a^3a^4

$(aaa)(aaaa)$

m^2m^5

$7^4 \cdot 7^2$

QUESTION 2

Simplify b^6b^3 as one power. State when the product law does not apply.

QUESTION 3

Cancel common factors, then write each quotient as one power.

Expression**After common factors cancel****One power**

$\frac{k^7}{k^3}$

$\frac{kkkkkkkk}{kkk}$

$\frac{n^9}{n^4}$

$\frac{10^6}{10^2}$

QUESTION 4

Simplify $\frac{p^{11}}{p^5}$.

QUESTION 5

Write c^4c^6 as one power.

QUESTION 6

Write $\frac{r^{12}}{r^5}$ as one power.

QUESTION 7

Nora wrote $5^2 \cdot 5^3 = 10^5$. Explain her mistake and give the correct answer.

QUESTION 8

One file contains 2^7 blocks. Another contains 2^5 blocks. Write the number of possible pairs as one power.

QUESTION 9

For positive whole-number exponents, Ava claims that $x^ax^b = x^cx^d$ whenever $a + b = c + d$.

- a) Is Ava's claim always true?
- b) Use the exponent laws to justify your decision.

Powers of Products, Quotients, and Powers

Name _____

Block _____

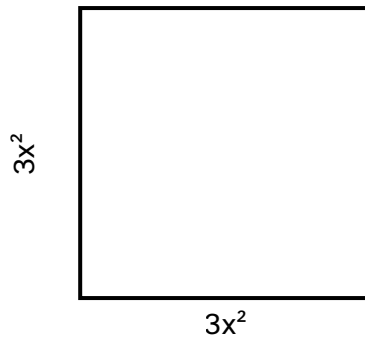
Date _____

QUESTION 1

Two students simplify $(2x)^3$. One gets $2x^3$. The other gets $8x^3$. Expand the power to decide who is correct.

QUESTION 2

The square has side length $3x^2$.



Write the area as a product of the side lengths, then simplify.

QUESTION 3

Simplify $(y^4)^3$.

QUESTION 4

Simplify $\left(\frac{a}{b}\right)^3$. State the restriction on b .

QUESTION 5

Simplify $(3a)^2$.

QUESTION 6

Simplify $(x^3)^4$.

QUESTION 7

A cube has edge length $2k^3$ centimetres. Write its volume as a power of the edge length, then simplify.

QUESTION 8

Harper wrote $(4r^3)^2 = 4r^6$. Find the mistake and fix the answer.

QUESTION 9

Mia says, "A power distributes over every operation, so $(a + b)^2 = a^2 + b^2$."

a) Test Mia's claim using $a = 1$ and $b = 1$.

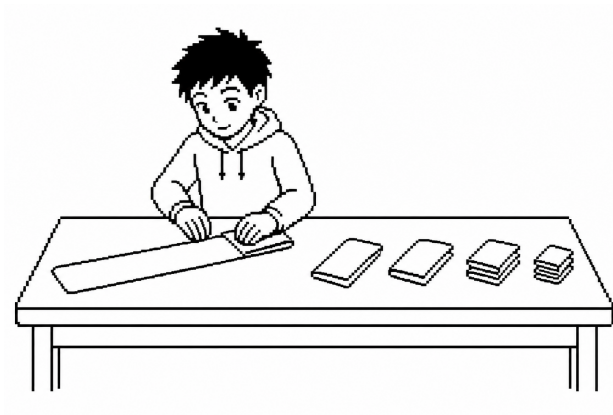
b) Explain why the power-of-a-product law cannot justify her claim.

Zero Exponents, Signs, and Mixed Laws

Name _____

Block _____

Date _____

QUESTION 1

Continue the exponent pattern by dividing each value by 5.

Power	5^4	5^3	5^2	5^1	5^0
Value	625				

QUESTION 2

Find 12^0 . Then complete the rule.

$x^0 =$ is valid when $x \neq$.

QUESTION 3

Evaluate $(-4)^2$. Then describe exactly what is included in the base.

QUESTION 4

Simplify $\frac{x^5 x^3}{x^8}$. Identify the exponent law used at each change and state any restriction.

QUESTION 5

Riley wrote $6^0 = 0$. Use $\frac{6^3}{6^3}$ to show Riley why the answer is 1.

QUESTION 6

For $\frac{(x^a)^b x^c}{x^d}$, all exponents are whole numbers and $ab + c \geq d$. Simplify. State the law used at each step and any restriction.

QUESTION 7

Calculate $(-2)^4$ and -2^4 .

QUESTION 8

Simplify $\frac{m^3m^2}{m^5}$, where $m \neq 0$.

QUESTION 9

Dev says, " $\frac{(x-2)^3}{(x-2)^3} = (x-2)^0 = 1$ for every value of x ."

- a) Test the original quotient when $x = 2$.
- b) Correct Dev's claim by stating the needed restriction.

Polynomial Language and Models

Name _____

Block _____

Date _____

QUESTION 1

Look at $4x^2 - 7x + 3$. List its terms. Then name its coefficients, constant, and degree.

QUESTION 2

Classify $9x^2$ as a monomial, binomial, or trinomial. State its degree.

QUESTION 3

Which two terms are like terms?

$3x^2$	$-5x$	$7x^2$	4
--------	-------	--------	---

QUESTION 4

Write $5 + 2x^2 - 7x + 3x^2$ in descending order without combining. Then identify the like terms.

QUESTION 5

Combine like terms: $6x + 4 - 2x + 7$.

QUESTION 6

Decide whether $5x$ and $-2x$ are like terms. Justify your answer.

QUESTION 7

Classify $5x^2 - 3x + 8$ and state its degree.

QUESTION 8

Combine like terms: $7y^2 + 3y - 2y^2 - 5$.

QUESTION 9

Two algebra-tile models each use six tiles.

	x^2 tiles	x tiles	unit tiles
Model A	2	1	3
Model B	1	3	2

Noah says the models represent the same polynomial because they use the same number of tiles. Test his claim by writing each polynomial.

Adding and Subtracting Polynomials

Name _____

Block _____

Date _____

QUESTION 1

Two students add $(3x + 5) + (4x - 2)$. One gets $7x + 3$. The other gets $10x$. Use $x = 2$ to decide who is correct.

QUESTION 2

Rewrite $(8x + 3) - (5x - 4)$ as addition of the opposite. Then simplify.

QUESTION 3

Complete the missing polynomial.

$$(2x^2 + 3x - 4) + \square = 7x^2 - x + 5$$

QUESTION 4

A rectangle has length $3x + 2$ metres and width $x - 1$ metres. Write and simplify its perimeter.

QUESTION 5

A student wrote $(4x^2 + 3x) + (2x^2 - 5x) = 6x^2 + 8x$. Locate the error and correct the result.

QUESTION 6

The table shows the amounts collected by three teams.

Team	First	Second	Third
Amount (kg)	$2x^2 + 4x - 3$	$x^2 - 6x + 8$	$3x^2 + x + 5$

Write a simplified expression for the total.

QUESTION 7

Simplify $(5x^2 + 2x - 1) - (2x^2 - 3x + 4)$.

QUESTION 8

Find the missing polynomial: $(x^2 + 4x) + \quad = 3x^2 - x + 6$.

QUESTION 9

Ravi claims, "Subtracting a polynomial makes every coefficient smaller." Test his claim by simplifying

$$(2x^2 - 5x + 1) - (x^2 - 8x + 4).$$

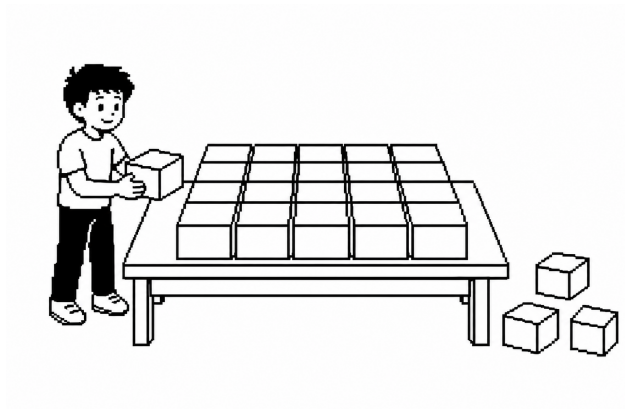
Use your result to explain whether Ravi is correct.

Multiplying and Dividing by a Monomial

Name _____

Block _____

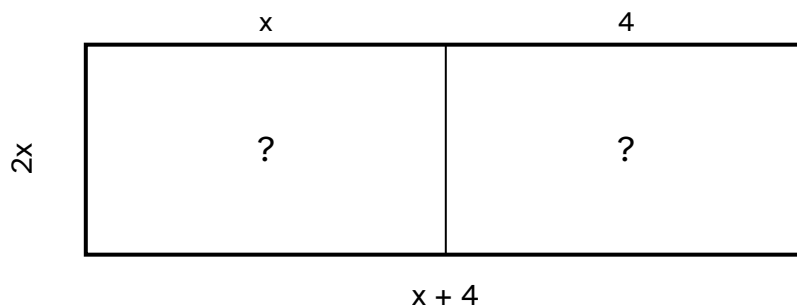
Date _____

QUESTION 1

A rectangle has height $5x$ and width $x + 3$. Is its area $5x^2 + 3$ or $5x^2 + 15x$? Explain your choice.

QUESTION 2

The rectangle has width $2x$ and length $x + 4$.



Label the area of each section.

QUESTION 3

Simplify $\frac{12x + 18}{6}$.

QUESTION 4

Factor out the greatest common monomial from $8x + 20$.

QUESTION 5

A student wrote $4x(2x + 3) = 8x^2 + 3$. Identify the missed multiplication and correct the result.

QUESTION 6

A rectangular banner has area $6x^2 + 15x$ square centimetres and height $3x$ centimetres. Find its length.

QUESTION 7

Expand $-4x(2x - 3)$.

QUESTION 8

Simplify $\frac{18x^2 - 12x}{6x}$.

QUESTION 9

Rectangle A has dimensions $3x$ by $2x + 5$. Rectangle B has dimensions x by $6x + 15$, where $x > 0$.

- a)** Show that the rectangles always have the same area.
- b)** A classmate claims they must also have the same perimeter. Test the claim.

Combining Polynomial Operations

Name

Block

Date

QUESTION 1

Simplify $3(x + 4) + 2x$. Why must you remove the brackets before collecting like terms?

QUESTION 2

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

QUESTION 3

Evaluate $2(x + 3) + x(x - 1)$ at $x = 4$ in two ways: before simplifying and after simplifying.

QUESTION 4

A square has side length $2x + 1$. A rectangular strip with area $3x(2x + 1)$ is attached along one side. Write the total area without expanding the square.

QUESTION 5

A solution begins $2x(3x - 4) + x^2 = 6x^2 - 4 + x^2$. Identify the first error and correct the final result.

QUESTION 6

The outer rectangle has length $5x + 2$ and width $2x$. A rectangle of area $3x^2 - 4x$ is removed. Write an expression for the remaining area.

QUESTION 7

Simplify $2(3x - 1) + x(x + 4)$.

QUESTION 8

Sam claims that $3(x^2 - 2x) + 2x(x + 1)$ and $5x^2 - 4x$ are equal for every value of x .

- a) Expand and simplify the first expression.
- b) Decide whether Sam's claim is true for every x .

One-Step and Two-Step Equations

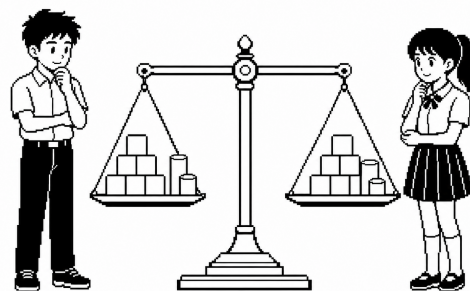
Name _____

Block _____

Date _____

QUESTION 1

For $x + 9 = 23$, compare three moves: subtract 9 from both sides, subtract 9 from only the left side, or divide both sides by 9. Which moves preserve the equality? Which move also reveals x ? Solve and check.

**QUESTION 2**

Solve $3x + 5 = 20$. Keep the equation balanced at every step.

QUESTION 3

Complete each missing value.

$4x - 7 = 21$, then $4x = \square$, so $x = \square$.

QUESTION 4

Choose the solution to $5x + 4 = 19$.

-6	-2	3	8
----	----	---	---

QUESTION 5

A solution begins $4x + 3 = 19$, so $4x = 22$. Identify the first error and correct the solution.

QUESTION 6

The perimeter of an equilateral triangle is 42 cm. Let s be the side length. Write an equation and solve it.

QUESTION 7

Solve $6x - 7 = 29$.

QUESTION 8

Solve $5 - 3y = -16$.

QUESTION 9

Omar says, "Doing the same thing to both sides always preserves the exact solution."

- a)** Start with $x = 4$ and multiply both sides by 0. What equation results?
- b)** Does the new equation still have only $x = 4$ as its solution? Correct Omar's claim.

Multi-Step Equations and Distribution

Name _____

Block _____

Date _____

QUESTION 1

For $3x + 5x - 6 = 18$, explain why combining $3x$ and $5x$ first preserves the solutions. Then solve and check.

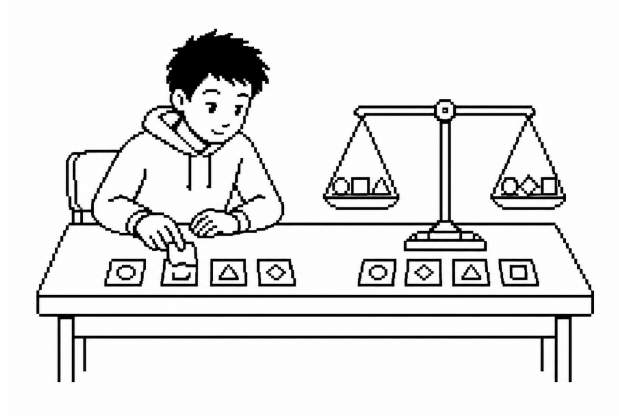
QUESTION 2

Distribute, collect, solve, and check: $3(x + 4) = 27$.

QUESTION 3

Solve $5x + 3 = 2x + 18$. Check your solution.

QUESTION 4



Arrange these steps in a sensible order, then solve $2(3x - 4) + 5 = x + 17$: distribute, collect like terms, move variable terms, move constants, divide by the coefficient.

QUESTION 5

A student wrote $3(2x - 5) = 6x - 5$. Identify the first error and correct the result.

QUESTION 6

Classify $3(x + 2) = 3x + 6$ as having one solution, no solution, or infinitely many solutions.

QUESTION 7

Solve $4(2x - 3) = 20$.

QUESTION 8

Solve $7x + 5 = 3x + 21$.

QUESTION 9

Maya says, "If the variable terms cancel, an equation always has infinitely many solutions."

Compare these equations:

$$2(x + 3) = 2x + 6$$

$$2(x + 3) = 2x + 7$$

Classify each equation, then correct Maya's claim.

Equations with Rational Coefficients

Name _____

Block _____

Date _____

QUESTION 1

Compare $0.5x + 3 = 8$ with the equation formed by multiplying every term by 10. Explain why the equations have the same solution, then solve.

QUESTION 2

Solve $\frac{x}{3} + 2 = 7$. You may clear fractions first.

QUESTION 3

Multiply $\frac{x}{2} + \frac{x}{3} = 10$ by the least common denominator. Write the new equation, then solve.

QUESTION 4

Choose whether fractions, decimals, or integers make $0.25x + 1.5 = 4$ easiest to solve. Explain your choice, then solve.

QUESTION 5

A solution begins $\frac{x}{4} + 3 = 7$, so $x + 3 = 28$. Identify the first error and correct the solution.

QUESTION 6

A recipe uses 0.75 kg of flour per batch. A bakery has used 6.3 kg from an 18.3 kg bag. Write an equation for the number of additional batches b , then solve it.

QUESTION 7

Solve $0.4x - 1.2 = 2.8$.

QUESTION 8

Solve $\frac{x}{4} + \frac{x}{2} = 9$.

QUESTION 9

Talia multiplies $\frac{x}{2} + \frac{3}{4} = 5$ by 4 and writes $2x + 3 = 5$.

- a) Identify the term she did not multiply by 4.
- b) Write the correct integer equation and solve it.

Modelling and Checking Linear Equations

Name _____

Block _____

Date _____

QUESTION 1

A student reads, “Seven more than three times a number is 34.” They write $3x + 7 = 34$ and $3(x + 7) = 34$. Which equation matches the sentence? Explain.

QUESTION 2

Solve the correct equation from Question 1. Check your answer in the sentence.

QUESTION 3

The length of a rectangle is 5 cm more than twice its width. Its perimeter is 58 cm. Let w be the width. Write the length in terms of w , then write and solve an equation to find both dimensions.

QUESTION 4

A club rents a room for \$120 and charges each participant \$18. The total collected is \$444. Write and solve an equation for the number of participants.

QUESTION 5

A student chooses $5x + 12 = 47$ for “Twelve less than five times a number is 47.” Explain the translation error and write the correct equation.

QUESTION 6

A 96 cm ribbon is cut into three pieces. The second piece is 8 cm longer than the first. The third is twice the first. Define a variable, write expressions for all three pieces, then write and solve an equation.

QUESTION 7

Five movie tickets and a \$3 fee cost \$58. Write and solve an equation for the ticket price.

QUESTION 8

Three consecutive whole numbers have a sum of 45. Find the numbers.

QUESTION 9

Plan A costs \$25 plus \$8 per visit. Plan B costs \$13 plus \$10 per visit. Jordan says Plan B must always cost less because its starting fee is lower.

- a)** Find the number of visits for which the plans cost the same.
- b)** Compare the plans at 4 visits and 8 visits. Use the results to assess Jordan's claim.

Representing Continuous Linear Relations

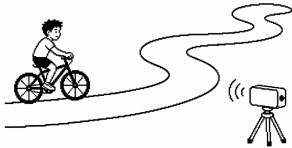
Name

Block

Date

QUESTION 1

A sensor reports the readings in the table. A student draws a straight line through them. What assumption makes that line reasonable, and what would make it misleading?

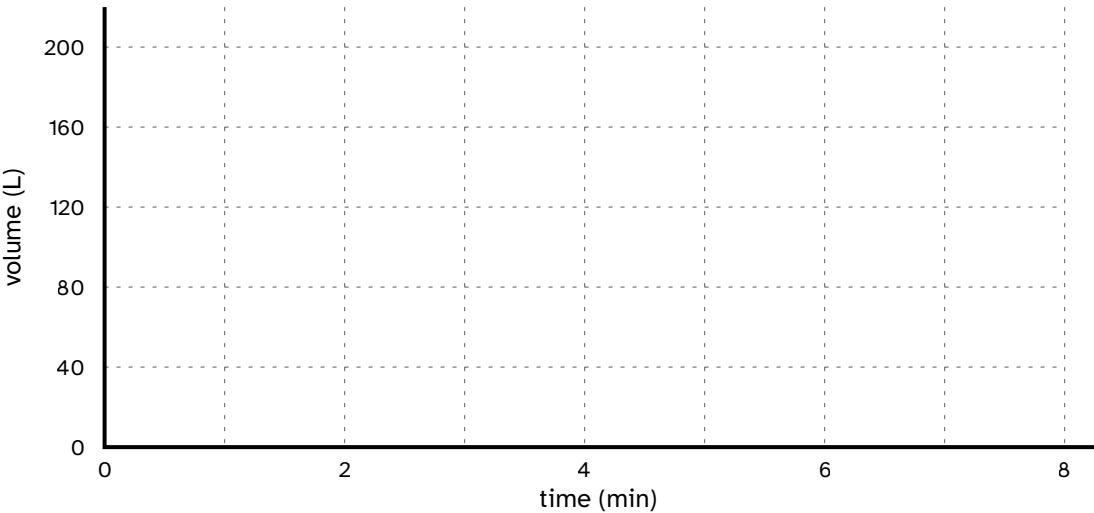


Time t (min)	0	1	2	3.5	6
Volume V (L)	40	55	70		

Use the constant-change assumption to complete the table.

QUESTION 2

Graph the relation from Question 1 for 0 to 8 minutes. Label both axes and use a sensible scale.

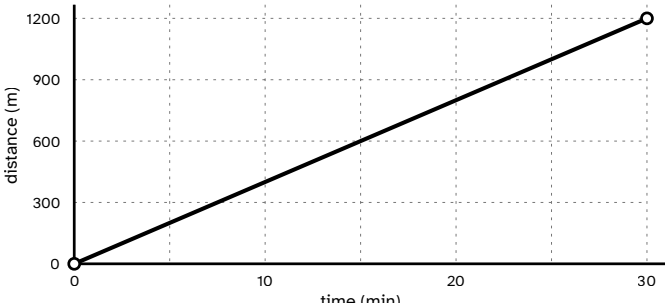


QUESTION 3

Decide whether a continuous graph is suitable for distance travelled while cycling over time.
Explain.

QUESTION 4

The graph shows a steady walk away from a trailhead.



Read the distance at 15 minutes.

QUESTION 5

Make a table with five points for $y = 60 - 8x$.

QUESTION 6

A graph passes through the points in the table.

Point	1	2	3
x	0	2	5
y	25	55	100

Show that the relation is linear using two rates of change.

QUESTION 7

For $y = 12 + 4x$, find y when $x = 7$.

QUESTION 8

Should the number of buses that arrive over time be shown with a continuous graph? Explain.

QUESTION 9

A cyclist's distance is recorded only at $(0, 4)$ and $(2, 10)$. Kai says, "Two points determine a line, so the cyclist must have travelled at a constant rate for the whole two minutes."

Explain what the two points do determine and what they do not prove about the cyclist's motion.

Rate of Change and Initial Value

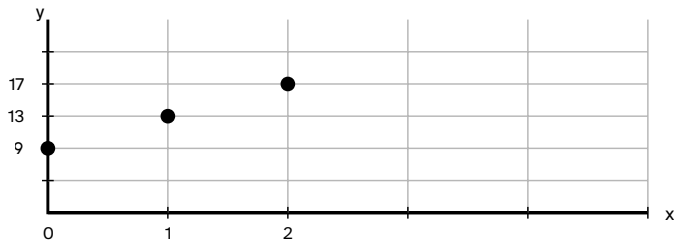
Name

Block

Date

QUESTION 1

For $y = 4x + 9$, set $x = 0$. Then increase x by 1. Which number is the initial value? Which is the rate of change?



QUESTION 2

Determine the rate of change and initial value from each table. Write a rule.

A				
x	0	2	5	8
y	7	17	32	47

B				
t	1	3	6	10
V	94	82	64	40

QUESTION 3

Find the rate of change between $(2, 11)$ and $(7, 31)$.

QUESTION 4

A line has rate of change -3 and passes through $(4, 10)$. Work backward to find the value at $x = 0$.

QUESTION 5

The graph of a cooling liquid passes through $(0, 92)$ and $(12, 68)$, where time is in minutes and temperature is in degrees Celsius. Calculate the rate of change.

QUESTION 6

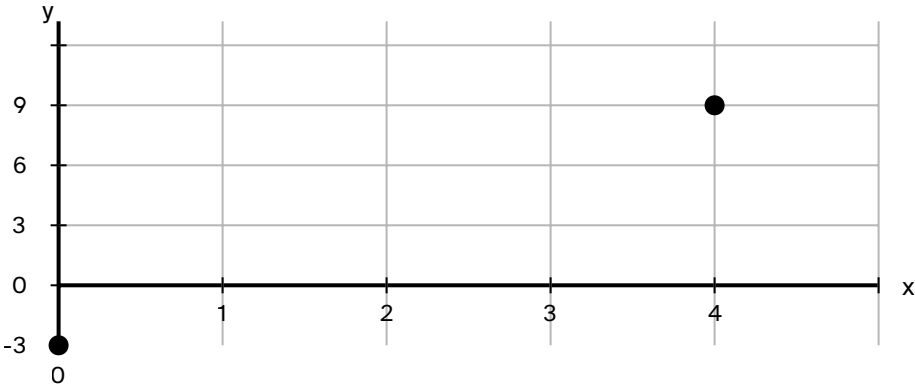
A student claims that in $y = 12 - 5x$, the initial value is -5 . Correct the claim.

QUESTION 7

State the rate of change and initial value of $y = -2.5x + 14$.

QUESTION 8

A line passes through $(0, -3)$ and $(4, 9)$. Write its rule.



QUESTION 9

Mina says, “Two linear relations with the same rate of change must be the same line.” Compare $y = 3x + 2$ with the relation in this table.

x	0	2	5
y	-4	2	11

Find the rate and initial value of the table, then assess Mina's claim.

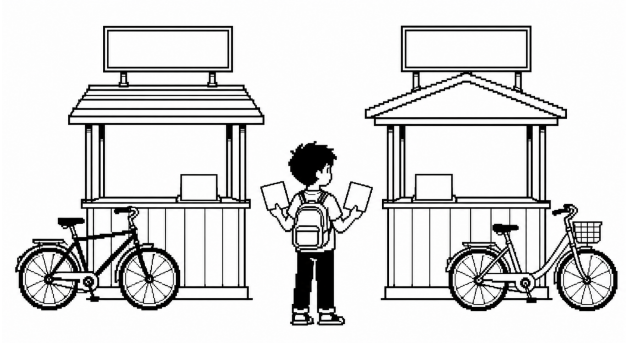
Comparing Linear Relations

Name

Block

Date

QUESTION 1



Two rental plans have costs $A = 18 + 2.4h$ and $B = 6 + 4h$. A student says, “Plan B starts cheaper, so it will always be cheaper.” Identify which plan starts lower and which increases faster.

QUESTION 2

The tables represent two continuous linear relations. Find the rate and initial value of each relation.

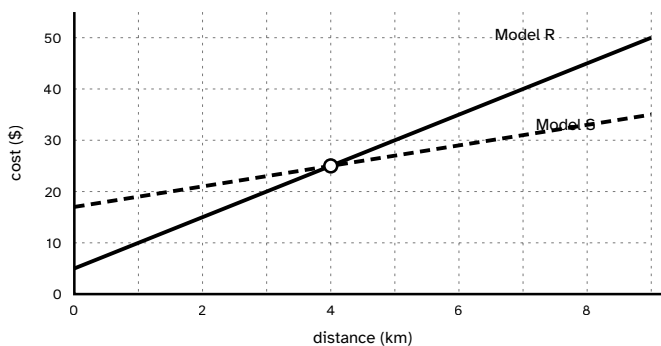
Relation P				
x	0	2	5	8
y	15	23	35	47
Relation Q				
x	1	4	8	11
y	23	32	44	53

QUESTION 3

Explain why comparing only one table row, one graph point, or one initial value can give a misleading conclusion about two linear relations.

QUESTION 4

The graph shows two delivery-cost models.



Which model has the lower initial cost? Which has the greater rate?

QUESTION 5

A gym charges \$45 to join and \$12 per visit. Another gym has no joining fee and charges \$17 per visit. Represent both costs with rules.

QUESTION 6

A student claims, "If one line is above another at $x = 0$, it must stay above because both lines are straight." Correct the claim using rates of change.

QUESTION 7

Find where $A = 20 + 3x$ and $B = 8 + 5x$ are equal.

QUESTION 8

At $x = 10$, which is lower: $A = 20 + 3x$ or $B = 8 + 5x$?

QUESTION 9

Return to the two gym plans in Question 5. Lee says, "The no-fee gym is the better choice for everyone."

- a)** Find the number of visits for which the costs are equal.
- b)** Compare the costs for 6 visits and 15 visits. Decide when Lee's claim is true and when it is false.

Extrapolation and Limits of Prediction

Name

Block

Date

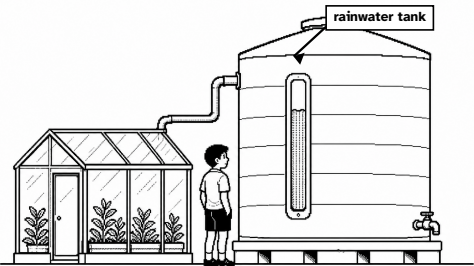
QUESTION 1

A wildlife team records the number of birds at a wetland each day from Monday through Saturday. It makes one estimate halfway between Wednesday and Thursday and another estimate two weeks later.

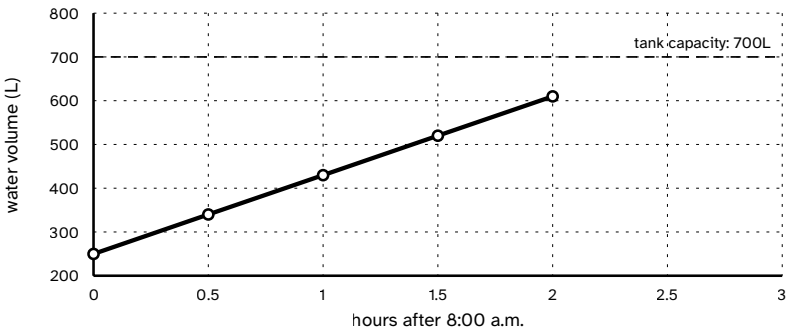
Which estimate requires the smaller assumption about the pattern continuing? Explain without calculating.

QUESTION 2

A sensor records the volume of water in a school greenhouse tank. From 8:00 a.m. to 10:00 a.m., the pump fills the tank at a constant rate.



Time	8:00	8:30	9:00	9:30	10:00
Volume (L)	250	340	430	520	610



Determine the filling rate in litres per hour.

QUESTION 3

School enrolment was 696 students in 2025. It had increased by 28 students each year from 2022 to 2025. Devon calculates $696 + 15(28) = 1116$ to predict the enrolment in 2040.

What part of Devon's calculation is correct? Why might the final prediction be wrong?

QUESTION 4

A community room has the following rental costs. The relationship is linear for rentals from 1 to 6 hours.

Rental time (h)	1	3	5
Cost (\$)	52	96	140

Determine a rule connecting rental time h and cost C .

QUESTION 5

At 10:00 a.m., a phone battery is at 86%. During steady use, its charge decreases by 8 percentage points each hour. A linear model for t hours after 10:00 a.m. is

$$B = 86 - 8t$$

Predict the battery charge at 4:00 p.m.

QUESTION 6

Two equipment-rental plans are modelled for h hours of use. The recorded rentals lasted between 0 and 5 hours.

$$A = 120 + 18h$$

$$B = 60 + 25h$$

Before calculating, identify which plan starts lower and which plan increases faster.

QUESTION 7

Data were collected for $1 \leq x \leq 5$. Is a prediction at $x = 3.5$ interpolation or extrapolation?

QUESTION 8

The model $y = 80 - 6t$ reaches zero at what value of t ?

QUESTION 9

Return to the rainwater tank in Question 2. Noor extends the constant-rate model to noon and predicts 970 L.

- a) Verify Noor's calculation using the starting volume and filling rate.
- b) Explain why 970 L is not a valid physical prediction.
- c) Find the time when the model first reaches the tank's 700 L capacity.

What Similarity Preserves

Name

Block

Date

QUESTION 1

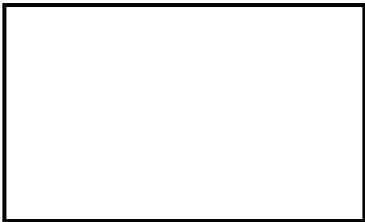
All four rectangles are larger or smaller versions of something, but which pairs keep the same shape? Decide before using the word *similar*.



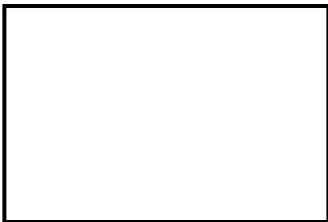
A: 5 by 3



B: 10 by 6



C: 9 by 6



D



Compare A with B and A with C using side-length ratios.

QUESTION 2

Corresponding position	1	2	3
Matching angle	40°	65°	75°
First side	4 cm	6 cm	8 cm
Corresponding side	6 cm	9 cm	12 cm

Show that one multiplier connects every pair of corresponding sides.

QUESTION 3

Two triangles have matching angles of 50° , 60° , and 70° . Are they similar?

QUESTION 4

Decide whether the claim is sufficient to prove that two figures are similar. Give a reason or counterexample.

They have the same area.

QUESTION 5

Are these triangles similar? If they are, give the scale factor.

First triangle

Second triangle

Sides: 3, 4, 5

Sides: 9, 12, 15

QUESTION 6

A student says, "Every pair of rectangles is similar because every rectangle has four right angles."

What feature did the student identify correctly?

QUESTION 7

A photograph is 12 cm by 18 cm.

Can it be printed at 20 cm by 30 cm without changing the shape? Justify.

QUESTION 8

Lena says, "Two rectangles with the same perimeter must be similar." She uses a 4 cm by 8 cm rectangle and a 5 cm by 7 cm rectangle.

Test Lena's claim. Use the dimensions to explain whether the rectangles are similar.

Scale Factors, Length, and Area

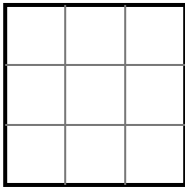
Name

Block

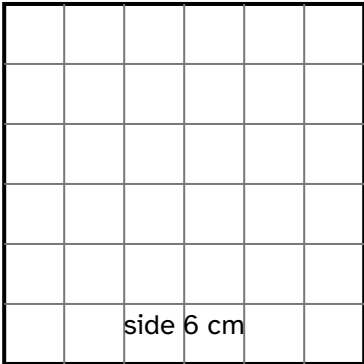
Date

QUESTION 1

A 3 cm square is enlarged to a 6 cm square. A student says, “The side doubled, so the area doubled.” Decide whether that must be true before using an area formula.



side 3 cm



side 6 cm

Count or calculate both areas.

QUESTION 2

A triangle with the side lengths shown below is enlarged by a scale factor of 2.4.

5 cm	7 cm	9 cm
------	------	------

Find the new side lengths.

QUESTION 3

Find the missing length in the similar pair.

$$\frac{4}{10} = \frac{x}{25}$$

QUESTION 4

Complete the relationships.

Length factor	Perimeter factor	Area factor
0.5		
1.5		
3		
k		

Explain why perimeter and area do not respond in the same way.

QUESTION 5

The area factor is 25. Find the positive length factor.

QUESTION 6

Two similar posters have areas 1800 cm^2 and 4050 cm^2 .

Find the area factor from the first to the second.

QUESTION 7

Correct this claim.

A scale factor of 4 multiplies area by 8.

QUESTION 8

Two similar posters have perimeters 48 cm and 72 cm. The smaller poster has area 80 cm^2 .

Sami says, "The perimeter is multiplied by 1.5, so the area must also be multiplied by 1.5."

Test Sami's claim and find the area of the larger poster.

Scale Drawings and Maps

Name

Block

Date

QUESTION 1

A map shows two towns 6 cm apart. Without a scale, one student says the towns are 6 km apart and another says 60 km. Why can neither claim be justified? A scale of 1:250 000 is then provided.

Explain what the two numbers in the scale compare.

QUESTION 2

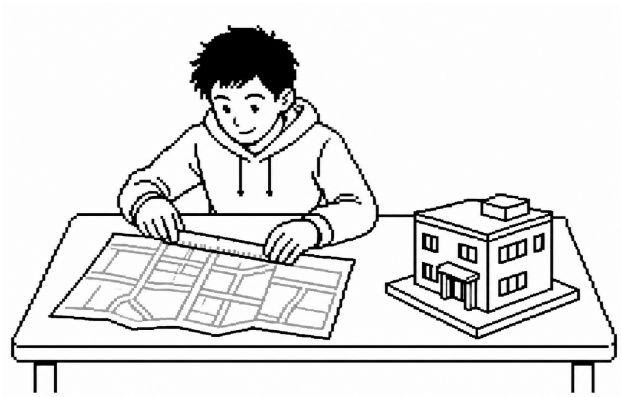
Use the scale 1:50 000.

What actual distance is represented by 1 cm?

QUESTION 3

A classroom plan uses 1 cm to represent 0.8 m. The room is drawn 10.5 cm by 8 cm.

Find the actual dimensions.



QUESTION 4

Choose a useful scale for drawing a 12 m by 18 m community garden on letter-size paper. State the finished drawing dimensions and justify why the scale is practical.

QUESTION 5

A model car is built at a scale of 1:24.

Real dimension	Length	Width	Height
Measurement	4.56 m	1.92 m	1.44 m

Find the model dimensions in centimetres.

QUESTION 6

Two floor plans show the same room. Plan A uses 1:100 and Plan B uses 1:50.

Which drawing is larger, and by what length factor?

QUESTION 7

A map was drawn at a scale of 1:50 000 and then printed at 125% of its original size. Two locations are 10 cm apart on the enlarged print.

Maya uses 10 cm with the original scale and says the actual distance is 5 km.

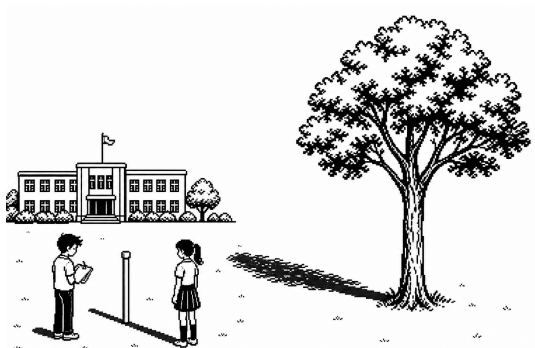
Test Maya's result. Find the actual distance and explain what she overlooked.

Indirect Measurement

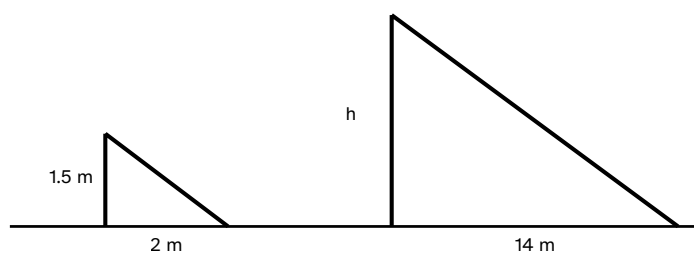
Name _____

Block _____

Date _____

QUESTION 1

A tree is too tall to measure directly. At the same moment, a 1.5 m pole casts a 2 m shadow and the tree casts a 14 m shadow. Why should shadows reveal height at all?



Identify the matching angles that make the two right triangles similar.

QUESTION 2

A student measures the pole shadow at 9:00 a.m. and the tree shadow at noon. Explain why combining those measurements may fail even if both are accurate.

QUESTION 3

A mirror is placed on level ground 8 m from a building. A student stands 1.6 m from the mirror and can see the roof. The student's eye height is 1.7 m.

Explain why reflection creates equal angles. Then use similar triangles to calculate the building height.

QUESTION 4

A photograph shows a person and a lighthouse standing on the same level ground. In the image, the 1.8 m person is 2.4 cm tall and the lighthouse is 38 cm tall.

Estimate the lighthouse height.

QUESTION 5

A surveyor uses similar triangles to find the width of a river. A 4 m baseline corresponds to 10 m along the far bank, while a 7 m measurement corresponds to the unknown width w .

Write and solve a proportion.

QUESTION 6

Correct this claim.

Any two shadows create similar triangles.

QUESTION 7

At the same moment, a 1.5 m pole casts a 2 m shadow on level ground. A nearby tree casts a 12 m shadow down a sloping path. Erin uses the proportion from Question 1 and reports a tree height of 9 m.

Decide whether Erin's result is justified. State what would need to be checked before using her proportion.

What Makes a Sample Trustworthy?

Name

Block

Date

QUESTION 1



A school wants to know whether students support a later start time. Two groups each ask 80 students.

Group	How students were chosen	Support later start
A	Students arriving before 8:00 a.m.	34%
B	Names chosen at random from the full student list	61%

Which sample better represents the whole school? Explain.

QUESTION 2

Why might a school use a sample instead of a census?

population	all 920 students at the school
sample	the 80 students who were asked
census	asking all 920 students

QUESTION 3

A recreation centre asks the first 50 people leaving the weight room about a new youth program. What group might this sample miss?

QUESTION 4

Decide whether the question is neutral or leading. Rewrite it if it is leading.

How much do you enjoy our excellent new lunch menu?

QUESTION 5

A music service asks only paying subscribers which features should remain free. It reports, "Users want fewer free features."

Identify the population suggested by the word *users*.

QUESTION 6

A school has 400 Grade 9 students. Design a representative sample of 40 students.

Travel group	Bus	Walk	Driven
Students	220	120	60

How many students should come from each travel group?

QUESTION 7

A student council posts a voluntary phone-policy poll to its social media followers. Of 600 responses, 78% oppose the policy. A separate random sample of 120 students finds that 46% oppose it.

Jae says, “The 600-person poll must be more trustworthy because it is larger.”

Test Jae's claim. Decide which result better represents the whole school and explain why.

What Can an Average Hide?

Name

Block

Date

QUESTION 1

Two groups both have a mean score of 5.

Group A					Group B				
5	5	5	5	5	7	1	9	3	5

Verify that the means match. Compare the ranges and explain what the shared mean hides.

QUESTION 2

5	2	8	4	5	4	5
---	---	---	---	---	---	---

Calculate the mean, median, mode, and range.

QUESTION 3

Five workers earn these hourly wages.

\$18	\$68	\$17	\$19	\$18
------	------	------	------	------

Find the mean and median. Which better describes a typical wage? Recalculate both without the \$68 wage.

QUESTION 4

14	8	16	11	11
----	---	----	----	----

Find the mean, median, mode, and range.

QUESTION 5

A data set has a minimum of 3 and a range of 14. Find the maximum.

QUESTION 6

Two bus routes record travel times in minutes.

Route	Times				
C	20	19	21	20	20
D	25	10	30	20	15

Compare their means, medians, and ranges. Which route is more predictable?

QUESTION 7

A headline says, “The average household has 2.4 children.” Explain what 2.4 means and give a possible data set for five households.

QUESTION 8

Nora says, “Removing the greatest value from a data set always lowers the mean and median by the same amount.” Test her claim using this data.

6	4	21	5	4
---	---	----	---	---

How Can a Graph Persuade You?

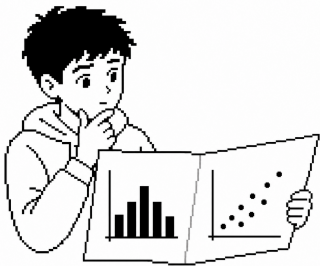
Name

Block

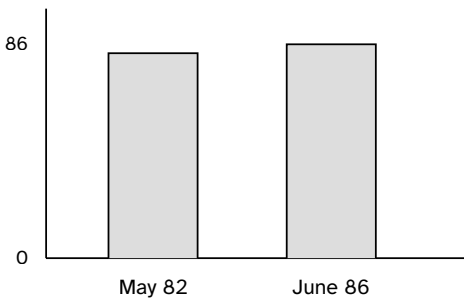
Date

QUESTION 1

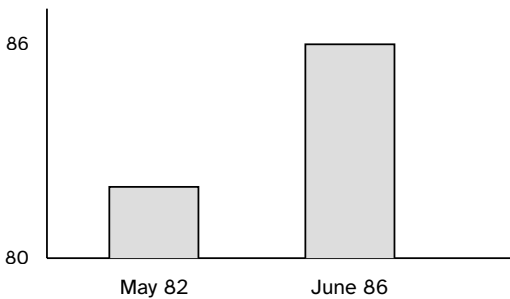
A company's monthly rating rises from 82 to 86. Both graphs show the same data.



Graph A: axis starts at 0



Graph B: axis starts at 80



Which graph makes the change look larger?

QUESTION 2

A graph of school attendance has no title, no units, and categories labelled A, B, C, D.

List three questions that cannot be answered reliably.

QUESTION 3

These are 12 students' commute times, in minutes.

14	8	20	10	26	13	9	18	12	19	10	11
----	---	----	----	----	----	---	----	----	----	----	----

Count how many times belong in each interval. Complete the table.

Time interval	5-9	10-14	15-19	20-24	25-29
Frequency					

QUESTION 4

A pictograph uses one full icon for 100 students. A category with 150 students is shown using two full icons.

Explain the error.

QUESTION 5

A news graphic doubles both the height and width of a square icon to represent a value that doubled.

How does the icon's area change?

QUESTION 6

Choose an effective display for each purpose and justify it.

Changes in temperature over 24 hours.

QUESTION 7

An infographic compares 40 participants in Program A with 60 participants in Program B. It uses a circle 4 cm in diameter for A and a circle 6 cm in diameter for B.

The designer says, “The diameter ratio matches the participant ratio, so the picture is fair.”

Test the designer's claim by comparing the data ratio with the circle-area ratio.

Does the Evidence Support the Claim?

Name	Block	Date
------	-------	------

QUESTION 1

A study finds that students who carry water bottles earn higher grades. A headline says, “Water bottles improve learning.”

What relationship did the study observe? Give another factor that could affect both variables, then write a fair headline.

QUESTION 2

A company tests a study app with 24 volunteers. Twelve use the app and twelve do not. The app group improves by 8 points; the other group improves by 5.

Find the difference in improvement. State information needed for a fair comparison, then write one supported conclusion and one conclusion that goes too far.

QUESTION 3

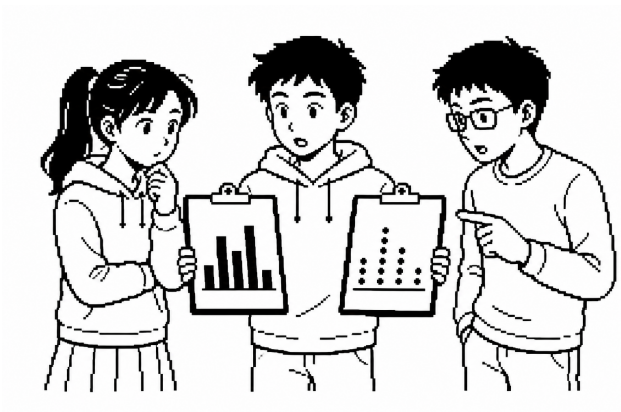
A survey reports 72% support for a park. The fine print says 50 of 300 invited residents responded.

How many respondents supported the park if the percentage was rounded to a whole number? Explain the response concern and write a more complete report.

QUESTION 4

For each source, identify one reason to trust it and one question or concern.

Source	Reason to trust	Question or concern
A city report with methods and raw counts		
An advertisement with no sources		
A clearly worded class survey using a convenience sample		

**QUESTION 5**

A survey invites 300 people and receives 90 replies. Find the response rate.

QUESTION 6

Study A follows 2,000 people for one month. Study B follows 200 people for five years.

Which study has the larger sample? What can each study reveal better? List two other features to compare before deciding which evidence is stronger.

QUESTION 7

A school compares last year's Grade 9 math mark of 68% with this year's mark of 74% and credits a new timetable.

Calculate the change in percentage points and the relative percent increase. Give another possible explanation and one way to strengthen the claim.

QUESTION 8

An energy-drink company compares 40 athletes who chose to use its drink with 40 athletes who did not. The drink group completes a fitness course 5 seconds faster on average.

The company claims, “Our drink makes athletes faster.”

State what the evidence actually shows. Give one other explanation for the difference and describe a fairer study that could test the company's claim.

Why Do Equal Percents Not Cancel?

Name	Block	Date
------	-------	------

QUESTION 1

A \$100 jacket rises in price by 20%, then the new price falls by 20%.

Find the final price. Why do the two changes not cancel?

QUESTION 2

A monthly fee rises from \$40 to \$46.

Find the percent increase.

QUESTION 3

Find the percent increase from \$80 to \$100.

QUESTION 4

Find the percent decrease from \$100 to \$80.

QUESTION 5

A store's return rate falls from 8% of purchases to 5%.

Find the decrease in percentage points.

QUESTION 6

Calculate percent change. State whether it is an increase or decrease.

\$75 to \$90

QUESTION 7

A phone plan rises 12% one year and 8% the next.
Starting at \$50, find the price after both increases.

QUESTION 8

Correct this claim.
A price that doubles has increased by 200%.

QUESTION 9

A store discounts an item by 25%. Imani says, "Increasing the sale price by 25% will return the item to its original price."
Test Imani's claim. Find the percent increase from the sale price needed to restore the original price.

What Does a Sale Price Really Cost?

Name _____

Block _____

Date _____

QUESTION 1

A \$200 bicycle is 25% off and then taxed 12%. Three students make the predictions shown below.

\$150	\$168	\$174
-------	-------	-------

Explain the reasoning that might produce each prediction.

QUESTION 2

Store A takes 30% off, then another 20% off. Store B takes 50% off once.

Test both offers on a \$100 item. Which store costs less?

QUESTION 3

Two cereal boxes cost \$5.40 for 450 g and \$7.20 for 750 g.

Find each cost per 100 g. Which has the lower unit price? Give one non-price factor that could affect the choice.

QUESTION 4

Find the final cost with 12% tax.

\$48 with no discount

QUESTION 5

A \$90 item has two offers: 20% off or \$15 off.

Which offer saves more? Find the price where the savings are equal, then state which offer is better above that price.

QUESTION 6

A receipt lists the following amounts.

Entry	Subtotal	Discount	Tax	Total
Amount	\$63.50	\$9.53	\$6.48	\$60.45

Find the discount rate and tax rate to the nearest whole percent. Verify the discounted subtotal and total.

QUESTION 7

Three identical games cost \$24 each. Store A offers “buy two, get one free.” Store B takes 35% off all three games.

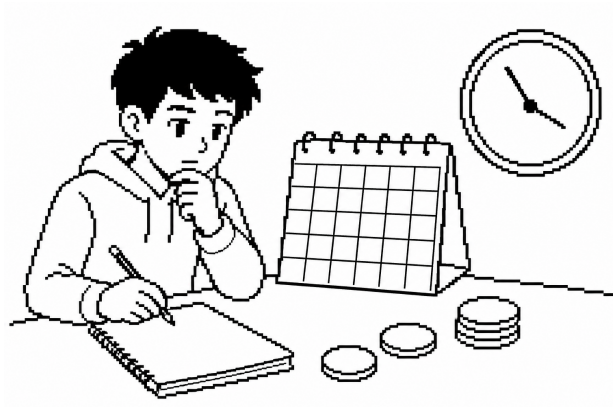
Which store has the lower total before tax? Explain why the larger-looking offer is not automatically the better one.

Why Does Money Have a Cost Over Time?

Name _____

Block _____

Date _____

QUESTION 1

A lender charges \$5 each year for every \$100 borrowed. A student borrows \$600 for 3 years.

Find the yearly and total interest. State the yearly rate and describe how principal, rate, and time affect simple interest.

QUESTION 2

Let P be the starting amount, r the yearly rate as a decimal, and t the time in years.

Explain why Pr gives one year's simple interest and why $I = Prt$ gives the interest after t years.

QUESTION 3

Compare two \$1,000 loans for 2 years.

Loan	Simple yearly rate	Fee
A	6%	\$0
B	4.5%	\$40

Find the interest, fees, and total repayment for each loan. Which loan costs less?

QUESTION 4

Find the simple interest on \$1,200 at 4% per year for 2.5 years.

QUESTION 5

Find the simple interest and final amount.

\$800 at 5% per year for 4 years

QUESTION 6

Find the missing quantity.

$I = 90$, $P = 600$, and $t = 3$; find r .

QUESTION 7

For $I = 180$, $P = 1000$, and $r = 0.06$, find t .

QUESTION 8

A savings account uses simple interest of 4% per year on \$1,500.

Make a table of total amount after 0, 1, 2, 3, and 4 years. Describe the pattern and identify the initial value.

QUESTION 9

Two simple-interest loans each lend \$1,500. Loan X charges 4% per year with no fee. Loan Y charges 3% per year with a \$60 fee.

Tariq says, "Loan Y is always cheaper because its rate is lower."

Test Tariq's claim. Find when the total costs are equal and state which loan is cheaper before and after that time.

Can a Budget Make a Decision for You?

Name

Block

Date

QUESTION 1

Sam has \$620 of monthly income and these planned costs.

Cost	Amount
Transit	\$92
Phone	\$55
Food	\$180
Savings	\$100
Entertainment	\$145
Other	\$70

Find the surplus or shortfall. Explain the purpose of the savings entry and propose one revision that balances the budget without reducing it.

QUESTION 2

Sam wants a \$480 laptop. Compare three choices.

Choice	Terms
Save first	\$80 per month
Borrow	8% simple interest for 1 year
Installments	12 payments of \$43 plus a \$25 fee

Find the time or total cost for each choice. Recommend one choice and state the tradeoff.

QUESTION 3

An emergency expense of \$240 occurs.

If Sam has \$600 saved, what percent of the savings is used?

QUESTION 4

Classify the cost as fixed, variable, or occasional. Explain any answer that depends on the situation.

monthly transit pass

**QUESTION 5**

A credit offer advertises “Only \$25 per month” for 24 months on a \$500 purchase.

Find the total paid, the credit cost, and the percent extra paid compared with cash. What does the advertisement hide?

QUESTION 6

Correct this claim.

A balanced budget must spend every dollar.

QUESTION 7

Lee has a \$35 monthly budget surplus. A bicycle costs \$500 cash, or 18 monthly payments of \$32 plus a \$24 fee.

Lee says, "The installment plan is affordable because \$32 is less than my \$35 surplus."

Test Lee's claim. Compare the total costs and explain what the monthly surplus does and does not prove.