NEGATIVE GRADIENTS

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

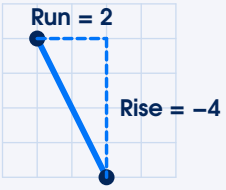
KEY IDEA

Read a line from LEFT to RIGHT, like reading words.

Uphill ↗ : the Rise is positive. Downhill ↘ : the Rise is negative.

Gradient $= \frac{\text{Rise}}{\text{Run}}$ **Here:** $\frac{-4}{2} = -2$

4 squares DOWN means Rise = –4.



1 Is each line uphill or downhill? Circle your answer.



a) UPHILL DOWNHILL b) UPHILL DOWNHILL c) UPHILL DOWNHILL

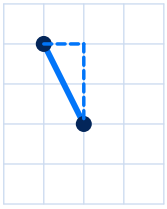
2 Work out each calculation.

Different signs → negative answer. Same signs → positive answer.

$-6 \div 2 =$ ☐ $8 \div -4 =$ ☐ $-3 \times 2 =$ ☐ $-10 \div -5 =$ ☐

3 These lines go downhill, so the Rise is negative. Fill in the boxes.

a)



Run ☐

Rise ☐

Gradient = $\frac{\text{Rise}}{\text{Run}}$ = ☐

b)



Run ☐

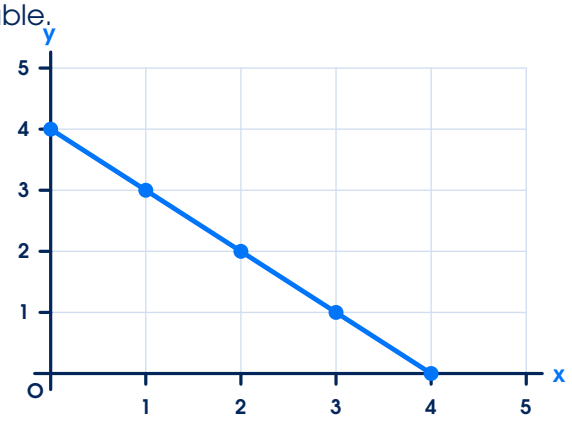
Rise ☐

Gradient = $\frac{\text{Rise}}{\text{Run}}$ = ☐

4 a) Read the points on this line. Complete the table.

x	0	1	2	3	4
y	4	3	☐	☐	☐

b) As x goes up, y goes UP DOWN



NEGATIVE GRADIENTS

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

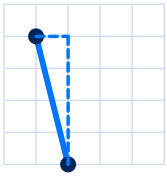
Gradient = $\frac{\text{Rise}}{\text{Run}}$

Line goes DOWN from left to right → the Rise is negative.

Here: Rise –6, Run 2. Gradient = $\frac{-6}{2}$ = –3

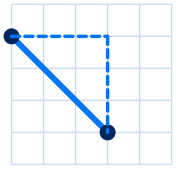


1 Find the gradient of each line.

a) 

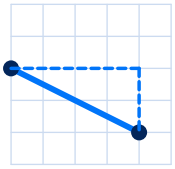
Rise ☐ Run ☐

Gradient = $\frac{\text{Rise}}{\text{Run}}$ = ☐

b) 

Rise ☐ Run ☐

Gradient = $\frac{\text{Rise}}{\text{Run}}$ = ☐

c) 

Rise ☐ Run ☐

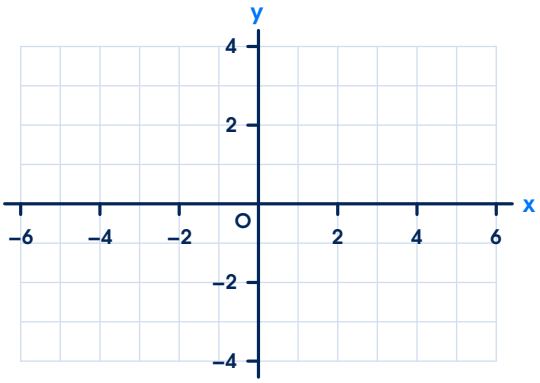
Gradient = $\frac{\text{Rise}}{\text{Run}}$ = ☐

2 a) Complete the table of values for y = –2x

x	–2	–1	0	1	2
y	☐	☐	☐	☐	☐

b) Plot the points. Draw the line y = –2x.

Remember: –2 × –1 = 2



3 Sort the equations by their gradient.

y = –3x | y = 5x | y = –½x | y = x | y = –x | y = 0.2x

Positive gradient

Negative gradient

4 Lucy says, "The gradient of y = –4x is 4." Explain Lucy's mistake.

NEGATIVE GRADIENTS

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

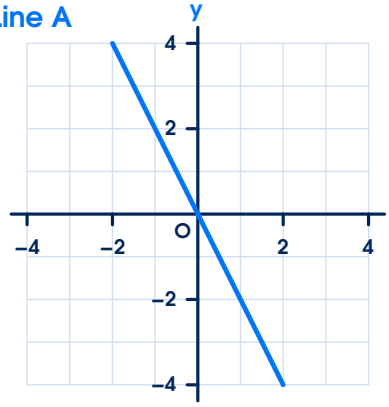
Gradient = $\frac{\text{Rise}}{\text{Run}}$

When y decreases as x increases, the Rise is negative, so the gradient is negative. Watch the signs.

FLUENCY

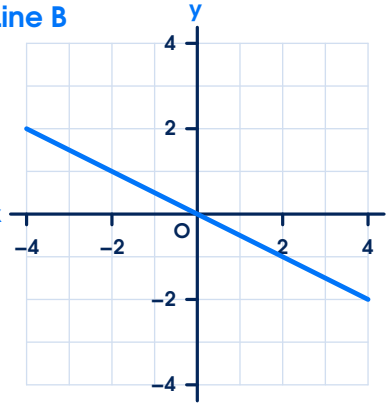
1 Find the gradient of each line.

Line A



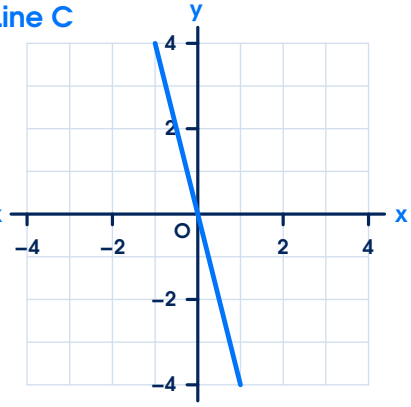
Gradient = ☐

Line B



Gradient = ☐

Line C



Gradient = ☐

2 A straight line passes through each pair of points. Find its gradient.

a) (−2, 6) and (3, −4) ☐

b) (1, 5) and (5, 3) ☐

c) (0, 0) and (4, −12) ☐

d) Gradient of y = −5x: ☐

REASONING

3 Write the lines in order of steepness, least steep first. Ignore whether they go up or down.

y = −5x **y = 2x** **y = −0.5x** **y = −3x**

☐ → ☐ → ☐ → ☐

4 What is the same and what is different about the lines y = 2x and y = −2x?

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NEGATIVE GRADIENTS

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) A line with a negative gradient goes down from left to right. ALWAYS SOMETIMES NEVER

b) The line y = –3x is steeper than the line y = 2x. ALWAYS SOMETIMES NEVER

c) On a line y = mx, as x increases, y decreases. ALWAYS SOMETIMES NEVER

d) The gradient of the line y = –mx is negative. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 A straight line through the origin has a gradient of –3.

a) It goes through (k, 12). Find k. ☐ **b)** It goes through (5, h). Find h. ☐

3 The lines y = 2x, y = –2x and y = –6 make a triangle.

a) Find the coordinates of the three corners.

(,) (,) (,) **b)** Area ☐

★ CHALLENGE FOR ALL

4 Rearrange each equation to the form y = mx if you need to.

a) Find the gradient of each line.

3y = –2x	4y = –x	2y = –6x
☐	☐	☐

b) Write a line through (0, 0) with a negative gradient that is less steep than all three.

NEGATIVE GRADIENTS

ANSWERS

BUILDING BLOCKS

1 a) downhill · b) uphill · c) downhill
2 −3 · −2 · −6 · 2
3 a) Run 1, Rise −2, gradient −2/1 = −2 · b) Run 2, Rise −2, gradient −2/2 = −1
4 a) 4, 3, 2, 1, 0 · b) down

SUPPORT

1 a) Rise −4, Run 1, gradient −4/1 = −4 · b) Rise −3, Run 3, gradient −3/3 = −1 · c) Rise −2, Run 4, gradient −2/4 = −1/2
2 a) 4, 2, 0, −2, −4 · b) straight line through (0, 0) going down from left to right
3 Positive: y = 5x, y = x, y = 0.2x · Negative: y = −3x, y = −(1/2)x, y = −x
4 The gradient is the number in front of x, including its sign: −4. The line goes down, so the Rise is negative: Rise/Run = −4/1 = −4.

CORE

1 A −4/2 = −2 · B −2/4 = −1/2 · C −4/1 = −4
2 a) −10/5 = −2 · b) −2/4 = −1/2 · c) −12/4 = −3 · d) −5
3 y = −0.5x, y = 2x, y = −3x, y = −5x
4 Same: both pass through the origin and are equally steep (Rise 2 for every Run of 1). Different: y = 2x goes up (gradient 2), y = −2x goes down (Rise −2, gradient −2). They are reflections in the y-axis.

GREATER DEPTH

1 a) Always · b) Always (3 > 2) · c) Sometimes: only when m is negative · d) Sometimes: true when m = 2, false when m = −2
2 a) k = −4 · b) h = −15
3 a) (0, 0), (−3, −6), (3, −6) · b) (1/2) × 6 × 6 = 18 square units
4 a) −2/3 · −1/4 · −3 · b) any y = mx with −1/4 < m < 0, e.g. y = −0.1x