Name & Surname: _____ Class: _____ Date: _____

Rising Lines

Rate of change and starting value in linear functions

About 60 minutes Level ★★★☆☆



Linear Functions in y = mx + b

A **linear function** has a straight-line graph with constant **rate of change**.

- y = mx + b, where m is the **slope** and b is the **starting value**.
- Slope m = (change in y) ÷ (change in x) = (y2 − y1) ÷ (x2 − x1).
- Starting value b is y when x = 0, where the line crosses the y-axis.

Task A

/18

Complete the tables and draw each line, then write its slope and intercept.

y = 2x + 1

x	−2	−1	0	1	2	3
y						

Gradient: _____

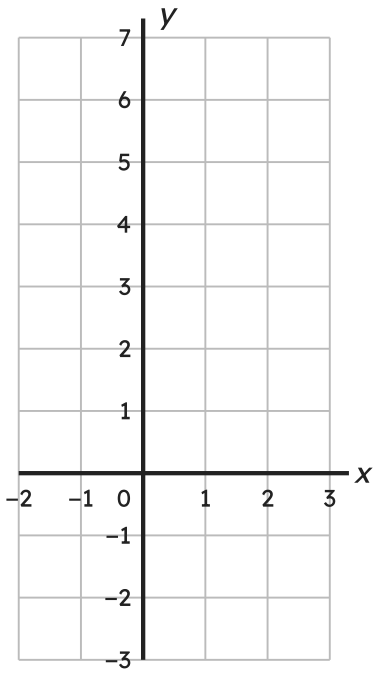
y-intercept: _____

y = 5 − x

x	−2	−1	0	1	2	3
y						

Gradient: _____

y-intercept: _____



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Find Slope First

Find rate of change and starting value from tables and graphs.

Key words

slope: rate of change; rise over run

rate of change: how much y changes per 1 x

linear function: function with a straight-line graph

y-intercept: point where x = 0

starting value: y-value when x = 0

Task B /12

Practise finding slope and starting value from equations, points, tables, and stories.

WARM UP

1. In y = 4x + 7, identify the **slope** and **starting value**.

   Answer: _____

2. Find the **slope** between (0, 2) and (4, 14).

   Answer: _____

3. Find the **slope** between (2, 5) and (6, 9).

   Answer: _____

4. A line crosses the y-axis at 6. What is **b** in y = mx + b?

   Answer: _____

PRACTISE

5. The **table** shows x: 0, 1, 2, 3 and y: 5, 8, 11, 14. Find the **rate of change** and b.

   Answer: _____

6. The **table** shows x: 0, 2, 4 and y: 10, 16, 22. Find the **rate of change** and b.

   Answer: _____

7. Points (1, 3) and (4, 12) lie on a **line**. Write the equation as y = mx + b.

   Answer: _____

8. Student A says the **slope** from (2, 3) to (5, 9) is (5 − 2) ÷ (9 − 3) = $\frac{1}{2}$. Explain the **mistake** and give the correct slope.

   Answer: _____

PROBLEM SOLVING

9. A tank holds 50 gal at time 0 and drains 5 gal per **hour**. Write y = mx + b for **gallons** left after x hours.

   Answer: _____

10. Use your **equation** to find gallons left after 6 hours, in **gal**.

    Answer: _____

11. A bike rental costs $8 plus $4 per **hour**. A rider pays $28. How many **hours** was the rental?

    Answer: _____

12. Explain what slope 4 and starting value 8 mean in the **bike** story.

    Answer: _____

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Model Real Life

Build equations from situations and explain what they mean.

Task C /12

Build models from pairs and tables, then explain the meaning.

WARM UP

1. **Table**: x: 0, 1, 2 and y: 3, 5, 7. What is **b**?

Answer: _____

2. Find the **slope** for that same **table**.

Answer: _____

3. Find the **slope** of the line through (0, 10) and (5, 0).

Answer: _____

4. In y = -2x + 15, identify the **slope** and **starting value**.

Answer: _____

PRACTISE

5. Savings are $25 in week 0 and $55 in week 2. Find the **rate** in dollars per **week**.

Answer: _____

6. Write y = mx + b for those **savings** after x **weeks**.

Answer: _____

7. Predict **savings** after 6 weeks, in **dollars**.

Answer: _____

8. Student B says the **starting value** is where the graph crosses the x-axis. Explain the **error**.

Answer: _____

PROBLEM SOLVING

9. Company A charges y = 12x + 30 dollars for x shirts. Company B gives (0, 20) and (5, 90). Which has the greater **rate of change**?

Answer: _____

10. Write the **equation** for Company B as y = mx + b.

Answer: _____

11. Find the **cost** of 10 shirts from Company A, in **dollars**.

Answer: _____

12. Explain what 12 and 30 mean in the Company A **cost** story.

Answer: _____

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Machines and Meanings

Use function machines and map the word slope.

Task D

/9

Find missing outputs and work backward to find missing inputs.

1 IN → × 2 → + 3 → OUT

In	Out
1	
4	
10	
	15
	29

2 IN → × 3 → − 4 → OUT

In	Out
2	
5	
	20
	32

Task E

/4

Complete the map that shows what slope means.

Definition (in my own words)

Characteristics

slope

Examples

Slope 2 means y rises 2 for each 1 step in x

Non-examples

The starting value where x = 0

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Patterns to Equations

See constant change in patterns, then study a full example.

Task F

/9

Find the missing terms and connect constant difference to slope.

1. 5, 8, 11, 14, ____, ____

nth term: _____

2. 40, 36, ____, 28, ____, 20

nth term: _____

3. 7, 12, 17, ____, ____

nth term: _____

Task G

/2

Study each example, then try the matching problem the same way.

WORKED EXAMPLE

A plant is 12 in. tall on day 0 and 22 in. tall on day 5. Find the rate of change.

1. Change in height = 22 − 12 = 10 in.
2. Change in time = 5 − 0 = 5 days
3. Rate m = 10 ÷ 5 = 2 in. per day

Answer: 2

YOUR TURN

A tank holds 100 gal at hour 0 and 64 gal at hour 6. Find the drain rate in gal per hour.

Answer: _____

WORKED EXAMPLE

Points (2, 11) and (6, 27) are on y = mx + b. Write the function.

1. m = (27 − 11) ÷ (6 − 2) = 16 ÷ 4 = 4
2. Use (2, 11): 11 = 4 × 2 + b, so b = 11 − 8 = 3
3. Function is y = 4x + 3

Answer: y = 4x + 3

YOUR TURN

Points (1, 9) and (4, 24) are on y = mx + b. Write the function.

Answer: _____

How did I do?

Circle a face for each line.

I can find the rate of change and starting value from a table, graph, or description.

I can write y = mx + b to model a linear relationship.

I can explain what slope and intercept mean in a real situation.

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Answer sheet: Rising Lines

Task A

y = 2x + 1: y = −3, −1, 1, 3, 5, 7; a straight line through these points; gradient 2, y-intercept 1

y = 5 − x: y = 7, 6, 5, 4, 3, 2; a straight line through these points; gradient −1, y-intercept 5

Task B

1. slope = 4, starting value = 7
2. 3
3. 1
4. 6
5. rate of change = 3, b = 5
6. rate of change = 3, b = 10
7. y = 3x
8. Switched run and rise; correct slope = (9-3) divided by (5-2) = 2
9. y = -5x + 50
10. 20
11. 5
12. Slope 4 means $4 added per hour; starting value 8 means $8 fee at 0 hours

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Task C

1. 3
2. 2
3. -2
4. slope = -2, starting value = 15
5. 15
6. y = 15x + 25
7. 115
8. Starting value is where x = 0, so it crosses the y-axis, not the x-axis
9. Company B with 14 dollars per shirt beats 12 dollars per shirt
10. y = 14x + 20
11. 150
12. 12 means $12 per shirt; 30 means $30 setup fee at 0 shirts

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Task D

1. 1 → 5; 4 → 11; 10 → 23; 6 → 15; 13 → 29
2. 2 → 2; 5 → 11; 8 → 20; 12 → 32

Task E

Definition: The constant rate of change of a linear function, or rise over run.

Characteristics: Same between any two points on the line, Is m in y = mx + b, Positive if line rises left to right, negative if it falls

Examples: Slope 2 means y rises 2 for each 1 step in x, Miles per hour on a distance-time graph

Non-examples: The starting value where x = 0, Changing steepness on a curve

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Task F

1. 17, 20; nth term 3n + 2
2. 32, 24; nth term −4n + 44
3. 22, 27; nth term 5n + 2

Task G

1. -6
2. y = 5x + 4

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