

Equation of a Line Given Two Points

Starter

- (Review of last lesson) State the gradient and y -intercept of the following:
 - $y = 6x + 5$
 - $y = 9 - x$
 - $y + 7 = x$
- (Review of last lesson) State the equation of the line which has gradient 2 and y -intercept -3 .

Notes

We can find the equation of a line given two point but first we will look at two simpler situations.

Finding the gradient between two points

We can find the gradient of a line joining 2 points without drawing a diagram by using the formula:

$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

Geogebra: [Calculating the gradient between 2 points](#)

Success Criteria

- Label the 2 points (x_1, y_1) and (x_2, y_2) .
- Substitute the numbers into the formula $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$

E.g. 1 Find the gradient of the line passing through the following pairs of points:

- $(2, 4)$ and $(5, 19)$
- $(-3, 2)$ and $(5, 4)$

Working:

(a) **Label the points:** $(2, 4)$ $(5, 19)$
 (x_1, y_1) (x_2, y_2)

Sub. into formula: $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{19 - 4}{5 - 2} = \frac{15}{3} = 5$

E.g. 2* The gradient of a line passing through the point $(-3, 9)$ and $(p, 4)$ is 6. Find the value of p .

Finding the equation of a straight line given the gradient and 1 point

If we know the gradient of a line and a point that it passes through, we can find its equation.

Success Criteria

- Substitute the value for the gradient into the equation $y = mx + c$.
- Substitute the x -value and the y -value of the point into the equation from step 1 and solve the equation to find the value of c .
- Replace c by the value found in step 2 in $y = mx + c$.

E.g. 3 Find the equation of the line that has the gradient and passes through the point given:

- gradient = 3, passes through $(4, 5)$
- gradient = -2 , passes through $(7, -1)$

Working:

(a) **Substitute the gradient into $y = mx + c$:** $y = 3x + c$
Substitute $(4, 5)$ into $y = 3x + c$: $5 = 3 \times 4 + c$
 $5 = 12 + c$
 $c = -7$

The equation of the line is $y = 3x - 7$

Finding the equation of the line passing through 2 points

We are now in a position to find the equation of a line given two points that it passes through.
Success Criteria

1. Find the gradient between the the 2 points using $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$
2. Substitute the value for the gradient into the equation $y = mx + c$.
3. Choose either of the given points. Substitute the x -value and the y -value of the point into the equation from step 1 and solve the equation to find the value of c .
4. Replace c by the value found in step 2 in $y = mx + c$.

E.g. 4 Find the equation of the line passing through

(a) (2, 1) and (4, 11)

(b) (2, 3) and (6, -5)

Working: (a) Label the points: (2, 1) (4, 11)

$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{11 - 1}{4 - 2} = \frac{10}{2} = 5$$

Substitute the gradient into $y = mx + c$: $y = 5x + c$

Substitute (2, 1) into $y = 5x + c$: $1 = 5 \times 2 + c$

$$1 = 10 + c$$

$$c = -9$$

The equation of the line is $y = 5x - 9$

Video: [Finding the equation of a straight line passing through two points](#)

[Solutions to Starter and E.g.s](#)

Exercise

p51 Ex 14.5 Qu 1-7

Summary

Finding the gradient between two points:

1. Label the 2 points (x_1, y_1) and (x_2, y_2) .
2. Substitute the numbers into the formula $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$

Finding the equation of a straight line given the gradient and 1 point:

1. Substitute the value for the gradient into the equation $y = mx + c$.
2. Substitute the x -value and the y -value of the point into the equation from step 1 and solve the equation to find the value of c .
3. Replace c by the value found in step 2 in $y = mx + c$.

Finding the equation of the line passing through 2 points:

1. Find the gradient between the the 2 points using $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$
2. Substitute the value for the gradient into the equation $y = mx + c$.
3. Choose either of the given points. Substitute the x -value and the y -value of the point into the equation from step 1 and solve the equation to find the value of c .
4. Replace c by the value found in step 2 in $y = mx + c$.

[Textbook answers \(only available during a lockdown\)](#)