Graph Transformations

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Describe how the graph of $y = x^2 + 3$ is related to $y = x^2$, and give its turning point.

Step 1 · +3 is outside the function: f(x) + 3

Translation by (0, 3), up 3

Step 2 · Move the turning point (0, 0)

(0, 3)

Answer: Translation by vector (0, 3); turning point (0, 3)

Check: At x = 0, y = 0 + 3 = 3 ✓

2. Now try one with the steps

Describe the transformation from $y = x^2$ to $y = (x - 4)^2$, and give the new turning point.

Step 1 · –4 is inside: f(x – 4)

Step 2 · Vector

Step 3 · Turning point (0, 0) moves to

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Describe fully the transformation that maps y = f(x) onto y = f(x) + 5. [1]

2. Describe fully the transformation that maps y = f(x) onto y = f(x – 2). [1]

3. Describe fully the transformation that maps y = f(x) onto y = f(x + 3). [1]

4. Describe the transformation that maps y = f(x) onto y = –f(x). [1]

5. Describe the transformation that maps $y = f(x)$ onto $y = f(-x)$. [1]

6. The graph of $y = x^2$ is translated by the vector $(0, -4)$. Write the equation of the new graph. [1]

7. The graph of $y = x^2$ is translated by the vector $(3, 0)$. Write the equation of the new graph. [2]

8. $(2, 7)$ lies on $y = f(x)$. Write down the image of this point on $y = f(x) - 3$. [1]

9. $(2, 7)$ lies on $y = f(x)$. Write down the image of this point on $y = f(x + 2)$. [1]

10. $(2, 7)$ lies on $y = f(x)$. Write down the image of this point on $y = -f(x)$. [1]

11. $(2, 7)$ lies on $y = f(x)$. Write down the image of this point on $y = f(-x)$. [1]

12. Write down the turning point of $y = (x + 1)^2 - 6$. [2]

13. $y = x^2$ is translated by the vector $(-2, 5)$. Write the equation of the image. [2]

14. $y = \sin x$ is translated by the vector $(0, 1)$. What is the maximum value of the new graph, and at what angle between $0°$ and $360°$ does it occur? [2]

15. $y = f(x)$ has a minimum point at $(-3, 2)$. Find the minimum point of $y = f(x - 4) + 1$. [2]

4. Before you hand it in

y = f(x + 3) moves the graph 3 to the right

Inside the bracket the effect is opposite: x + 3 reaches each output 3 sooner, so the graph moves LEFT 3. Vector (–3, 0).

Confusing –f(x) and f(–x)

–f(x): the minus is OUTSIDE, so the y values flip — reflect in the x-axis. f(–x): the minus is INSIDE, so the x values flip — reflect in the y-axis.

Describing a translation as 'moves 4 units'

'Describe fully' needs the type AND the vector: 'translation by the vector (4, 0)'.

y = x^2 translated by (3, 0) written = x^2 – 3

Horizontal changes go inside: y = $(x – 3)^2$. y = x^2 – 3 is a translation DOWN 3.