

Translating Graphs

Starter

1. **(Review of last lesson)** State the equation of the line needed to solve the following equations using the graph of $y = 2x^2 - 3x + 1$.

(a) $2x^2 - 3x + 3 = 9$

(b) $2x^2 - 5x - 7 = 0$

Working:

(a) $2x^2 - 3x + 3 = 9$

$2x^2 - 3x + 1 + 2 = 9$

$y + 2 = 9$

$y = 7$

separate curve within equation

replace $2x^2 - 3x + 1$ by y

rearrange

Draw $y = 7$

(b) $2x^2 - 5x - 7 = 0$

$2x^2 - 3x + 1 - 2x - 8 = 0$

$y - 2x - 8 = 0$

$y = 2x + 8$

separate curve within equation

replace $2x^2 - 3x + 1$ by y

rearrange

Draw $y = 2x + 8$

2. Write down the new coordinates of the points after the stated transformation:

(a) $(2, 5)$ is translated under the vector $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

(b) $(3, 1)$ is reflected in the x -axis

(c) $(2, 7)$ is reflected in the y -axis

Working:

(a) $(2, 5) \xrightarrow{\begin{pmatrix} 4 \\ -1 \end{pmatrix}} (6, 4)$

(b) $(3, -1)$ *change the sign of the y -coordinate*

(c) $(-2, 7)$ *change the sign of the x -coordinate*

- E.g.** Consider the function $y = (x + a)^2 + b$ where a and b are constants
What happens when we change a and b ?

Working:

The constant inside the brackets adding to the x , a , causes a horizontal translation.

The constant outside the brackets adding to the function, b , causes a vertical translation.

E.g. 1 Consider the function $y = x^3$.

- (a) Describe the translation(s) that takes $y = x^3$ to the function:
- (i) $y = x^3 - 6$
 - (ii) $y = (x + 7)^3$
 - (iii) $y = (x - 1)^3 + 8$
- (b) Give the equation of the curve after $y = x^3$ has undergone:
- (i) a translation of 3 units to the right
 - (ii) a translation of 2 units upwards
 - (iii) a translation $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$

Working:

(a) (i) $y = x^3 - 6$ *“to the function” so vertical
-6 so downwards*
Vertical translation, 6 units downwards

(ii) $y = (x + 7)^3$ *“to the x” so horizontal
+7 so to the left*
Horizontal translation, 7 units to the left

(iii) *“-1” is “to the x” so horizontal and since it is negative it
moves to the right*
*+8” is “to the function” so vertical and since it is
positive it moves up*
Horizontal translation, 1 unit to the right
and vertical translation, 8 units up

(b) (i) *“to the right” means horizontal so “to the x”
“3 units to the right” means -3*
 $y = (x - 3)^3$

(ii) *“upwards” means vertical so “to the function”
“2 units to the right” means +2*
 $y = x^3 + 2$

(iii) $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ *means 5 units right and 4 units down*
5 units right \Rightarrow “-5” is “to the x”
4 units down \Rightarrow “+4” is “to the function”
 $y = (x - 5)^3 + 4$

Video: [Transformation of graphs A](#)

Video: [Transformation of graphs B](#)

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

Exercise

9-1 class textbook: p553 E17.3 Qu 1abd, 2abc, 3ace, 4-6, 8, 9ac, 10ab
A*-G class textbook: p511 E17.3 Qu 1abd, 2abc, 3ace, 4-7, 8ab, 9ac
9-1 homework book: p186 E17.3 Qu 1acd, 2abd, 3ac, 4, 6ab
A*-G homework book: p141 E17.3 Qu 1acd, 2abd, 3ac, 4

