# Transforming Graphs

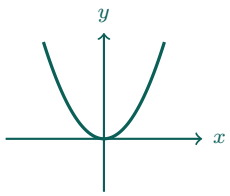
GCSE Mathematics • **Higher Tier** • Grades 8–9 • Non-calculator

**WORKED SOLUTIONS**

Name: worked example Class: _____ Total: 50 / 50

*Show all your working. Marks are given for correct method as well as the final answer.*

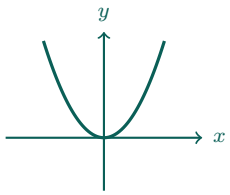
**1.** Describe the transformation from $y = f(x)$ to $y = f(x) + 3$. **[2 marks]**




OUTSIDE the bracket affects y
and does what it says: up 3

**Answer:** translation by $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$

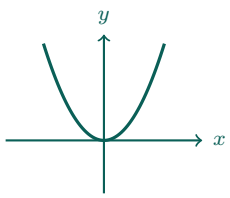
**2.** Describe the transformation from $y = f(x)$ to $y = f(x) - 5$. **[2 marks]**




down 5

**Answer:** translation by $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$

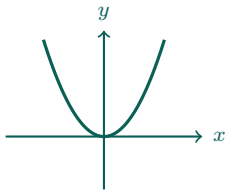
**3.** Describe the transformation from $y = f(x)$ to $y = f(x + 2)$. **[2 marks]**




INSIDE the bracket affects x
and does the OPPOSITE: left 2
+2 inside moves it LEFT

**Answer:** translation by $\begin{pmatrix} -2 \\ 0 \end{pmatrix}$

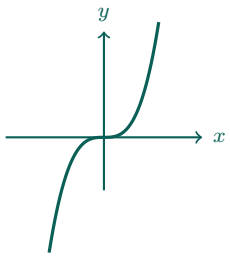
**4.** Describe the transformation from $y = f(x)$ to $y = f(x - 4)$. **[2 marks]**




*-4 inside moves it RIGHT 4*

**Answer:** ____ *translation by* $\binom{4}{0}$ ____

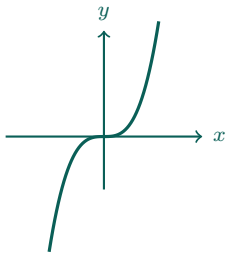
**5.** Describe the transformation from $y = f(x)$ to $y = -f(x)$. **[2 marks]**




*the minus is outside, so y values flip sign*

**Answer:** ____ *reflection in the x-axis* ____

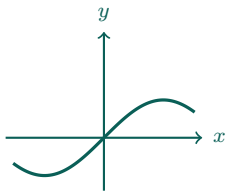
**6.** Describe the transformation from $y = f(x)$ to $y = f(-x)$. **[2 marks]**




*the minus is inside, so x values flip sign*

**Answer:** ____ *reflection in the y-axis* ____

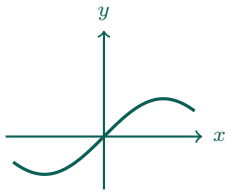
**7.** Describe the transformation from $y = f(x)$ to $y = 3f(x)$. **[2 marks]**




*outside, so it stretches vertically*
*every y value is tripled*

**Answer:** ____ *stretch, scale factor 3, parallel to the y-axis* ____

**8.** Describe the transformation from $y = f(x)$ to $y = f(2x)$. **[3 marks]**




inside, so it acts horizontally
and does the RECIPROCAL: squashed to half
f(2x) is NOT a stretch of 2

**Answer:** ____ stretch, scale factor $\frac{1}{2}$, parallel to the x-axis____

**9.** Describe the transformation from $y = f(x)$ to $y = f\left(\frac{1}{2}x\right)$. **[3 marks]**

reciprocal of $\frac{1}{2}$ is 2

**Answer:** ____ stretch, scale factor 2, parallel to the x-axis____

**10.** $(3, 5)$ lies on $y = f(x)$. Write down its image on $y = f(x) + 4$. **[2 marks]**

y goes up 4, x unchanged

**Answer:** _____ (3, 9)_____

**11.** $(3, 5)$ lies on $y = f(x)$. Write down its image on $y = f(x - 2)$. **[2 marks]**

the graph shifts RIGHT 2
3 + 2 = 5

**Answer:** _____ (5, 5)_____

**12.** $(3, 5)$ lies on $y = f(x)$. Write down its image on $y = -f(x)$. **[2 marks]**

y flips sign

**Answer:** _____ (3, -5)_____

**13.** $(3, 5)$ lies on $y = f(x)$. Write down its image on $y = f(-x)$. **[2 marks]**

x flips sign

**Answer:** _____ (-3, 5)_____

**14.** $(6, 2)$ lies on $y = f(x)$. Write down its image on $y = f(2x)$. **[3 marks]**

x is HALVED
6 ÷ 2 = 3

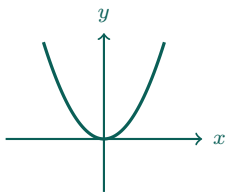
**Answer:** _____ (3, 2)_____

**15.** $(4, 7)$ lies on $y = f(x)$. Write down its image on $y = 2f(x)$. **[2 marks]**

y is doubled

**Answer:** _____ (4, 14)_____

**16.** $y = x^2$ has a minimum at $(0, 0)$. Write down the minimum of $y = (x - 3)^2$. **[2 marks]**




−3 inside moves it right 3

**Answer:** (3, 0)

**17.** Write down the minimum of $y = (x + 1)^2 - 4$. **[3 marks]**

+1 inside → left 1
−4 outside → down 4

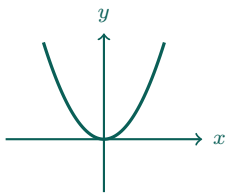
**Answer:** (−1, −4)

**18.** Write down the maximum of $y = 5 - x^2$. **[3 marks]**

$-x^2$ flips it upside down
+5 raises it to 5
a negative $x^2$ means a MAXIMUM

**Answer:** (0, 5)

**19.** The graph of $y = f(x)$ has a minimum at $(2, -3)$.




**(a)** Write down the minimum of $y = f(x) + 7$. **[2 marks]**

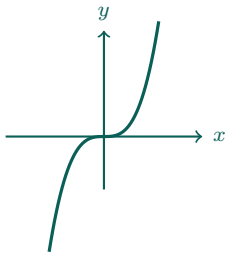
up 7
(2, 4)

**(b)** Write down the minimum of $y = f(x + 5)$. **[2 marks]**

left 5
(−3, −3)

**Answer:** (2, 4) ; (−3, −3)

**20.** The graph of $y = f(x)$ passes through $(-2, 6)$.




**(a)** Write down the image of that point on $y = -f(x)$. **[2 marks]**

y flips sign
(−2, −6)

**(b)** Write down the image of that point on $y = f(-x) + 1$. **[3 marks]**

f(−x) flips x: (2, 6)
then +1 raises y
(2, 7)

**Answer:** (−2, −6) ; (2, 7)

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