

GCSE MATHS • GRADE 7

MATHS



MODEL ANSWERS

FUNCTIONS

SCORE

/92

PERCENTAGE

%

STEM UP

1 $f(x) = 5x - 5$

(a) Find $f(-2)$.

(b) Find $f(4)$.

$$f(-2) = 5(-2) - 5 = -15$$

$$f(4) = 5(4) - 5 = 15$$

(a) -15 (b) 15

/ 1

2 $f(x) = -2x - 5$

Solve $f(x) = -1$.

$$-2x - 5 = -1$$

$$-2x = 4$$

$x = -2$

/ 1

3 $f(x) = 2x - 8$

$$g(x) = x^2 - 6x + 9$$

Find $gf(-3)$.

$$f(-3) = -14$$

$$= g(-14)$$

$$= 289$$

289

/ 1

4 $f(x) = -2x - 4$

(a) Find $f(5)$.

(b) Find $f(6)$.

$$f(5) = -2(5) - 4 = -14$$

$$f(6) = -2(6) - 4 = -16$$

(a) -14 (b) -16

1 / 1

5 $g(x) = 4x - 2$

Solve $g(x) = 10$.

$$4x - 2 = 10$$

$$4x = 12$$

$x = 3$

1 / 1

6 $f(x) = 6x + 1$

$$g(x) = x^2 + 10$$

Find $fg(3)$.

$$g(3) = 19$$

$$= f(19)$$

$$= 115$$

115

1 / 1

7 $g(x) = 6x + 4$

(a) Find $g(-4)$.

(b) Find $g(-1)$.

$$g(-4) = 6(-4) + 4 = -20$$

$$g(-1) = 6(-1) + 4 = -2$$

(a) -20 (b) -2

1 / 1

8 $f(x) = 6x + 7$

Find $f^{-1}(x)$.

$$y = 6x + 7$$

$$x = 6y + 7$$

$$x - 7 = 6y$$

$$y = \frac{x-7}{6}$$

$$\frac{x-7}{6}$$

1 / 1

9 $f(x) = 4x - 9$

Find $f^{-1}(8)$.

$$4x - 9 = 8$$

$$x = \frac{17}{4}$$

$$\frac{17}{4}$$

1 / 1

10 $f(x) = x^2 - 6x - 1$

(a) Find $f(5)$.

(b) Find $f(-1)$.

$$f(5) = (5)^2 - 6(5) - 1 = -6$$

$$f(-1) = (-1)^2 - 6(-1) - 1 = 6$$

(a) -6 (b) 6

1 / 1

11 $f(x) = 4x + 2$

Find $f^{-1}(x)$.

$$y = 4x + 2$$

$$x = 4y + 2$$

$$x - 2 = 4y$$

$$y = \frac{x-2}{4}$$

$$\frac{x-2}{4}$$

1 / 1

12 $f(x) = 2x + 3$

Find $f^{-1}(11)$.

$$2x + 3 = 11$$

$$x = 4$$

4

1 / 1

- 13 $g(x) = 2x^2 + 1$
Solve $g(x) = 73$.

$$2x^2 + 1 = 73$$

$$2x^2 = 72$$

$$x^2 = 36$$

$$x = \pm 6$$

$$x = 6 \text{ or } x = -6$$

1

 / 1

- 14 $f(x) = 6x + 8$
Find $f^{-1}(x)$.

$$y = 6x + 8$$

$$x = 6y + 8$$

$$x - 8 = 6y$$

$$y = \frac{x - 8}{6}$$

$$\frac{x - 8}{6}$$

1

 / 1

- 15 $f(x) = -2x - 3$
Find $ff(x)$.
Give your answer in its simplest form.

$$ff(x) = f(-2x - 3)$$

$$= -2(-2x - 3) - 3$$

$$= 4x + 3$$

$$4x + 3$$

1

 / 1

16 $h(x) = 2x + 9$

(a) Find $h(3)$.

(b) Find $h(-3)$.

(c) Solve $h(x) = 7$.

$$h(3) = 2(3) + 9 = 15$$

$$h(-3) = 2(-3) + 9 = 3$$

$$2x + 9 = 7$$

$$2x = -2$$

(a) 15 (b) 3 (c) $x = -1$

/ 1

17 $f(x) = -x - 4$

Solve $f^{-1}(x) = 4$.

$$f^{-1}(x) = 4 \text{ means } x = f(4)$$

$$f(4) = -(4) - 4$$

$x = -8$

/ 1

18 $f(x) = -2x - 1$

(a) Find $f(7)$.

(b) Find $f(-1)$.

(c) Solve $f^{-1}(x) = 2$.

$$f(7) = -2(7) - 1 = -15$$

$$f(-1) = -2(-1) - 1 = 1$$

$$f^{-1}(x) = 2 \text{ means } x = f(2)$$

$$f(2) = -2(2) - 1 = -5$$

(a) -15 (b) 1 (c) $x = -5$

/ 1

- 19 $f(x) = 4x + 3$
 (a) Find $f(3)$.
 (b) Find $f(-3)$.
 (c) Solve $f(x) = -9$.

$$f(3) = 4(3) + 3 = 15$$

$$f(-3) = 4(-3) + 3 = -9$$

$$4x + 3 = -9$$

$$4x = -12$$

$$(a) 15 (b) -9 (c) x = -3$$

$$\boxed{1} / 1$$

- 20 $f(x) = 2x + 1$
 Solve $f^{-1}(x) = -3$.

$$f^{-1}(x) = -3 \text{ means } x = f(-3)$$

$$f(-3) = 2(-3) + 1$$

$$x = -5$$

$$\boxed{1} / 1$$

- 21 $f(x) = x - 2$
 (a) Find $f(4)$.
 (b) Find $f(-1)$.
 (c) Solve $f^{-1}(x) = 2$.

$$f(4) = (4) - 2 = 2$$

$$f(-1) = (-1) - 2 = -3$$

$$f^{-1}(x) = 2 \text{ means } x = f(2)$$

$$f(2) = (2) - 2 = 0$$

$$(a) 2 (b) -3 (c) x = 0$$

$$\boxed{2} / 2$$

22 $f(x) = 6 \div (x + 3)$

(a) Find $f(3)$.

(b) Solve $f(x) = 3$.

$$f(3) = 6 \div 3 = 2$$

$$6 \div (x + 3) = 3$$

$$x + 3 = 2$$

(a) 1 (b) $x = -1$

2 / 2

23 $f(x) = x^2 + 3$ for $x \geq 0$

Solve $f^{-1}(x) = 8$.

$$f^{-1}(x) = 8 \text{ means } x = f(8)$$

$$f(8) = (8)^2 + 3$$

$x = 67$

2 / 2

24 $f(x) = -x + 1$

$$g(x) = 2x^2 + 8$$

Find an expression for $fg(x)$.

Give your answer in its simplest form.

$$fg(x) = f(2x^2 + 8)$$

$$= -(2x^2 + 8) + 1$$

$$= -2x^2 - 7$$

$-2x^2 - 7$

2 / 2

- 25 $f(x) = 12 \div (x + 3)$
 (a) Find $f(1)$.
 (b) Solve $f(x) = 12$.

$$f(1) = 12 \div 4 = 3$$

$$12 \div (x + 3) = 12$$

$$x + 3 = 1$$

$$(a) 3 \quad (b) x = -2$$

$$\boxed{2} / 2$$

- 26 $f(x) = 2x^2 - 3$
 (a) Find $f(2)$.
 (b) Find $f(-2)$.
 (c) Solve $f(x) = 47$.

$$f(2) = 2(2)^2 - 3 = 5$$

$$f(-2) = 2(-2)^2 - 3 = 5$$

$$2x^2 - 3 = 47$$

$$2x^2 = 50$$

$$x^2 = 25$$

$$x = \pm 5$$

$$(a) 5 \quad (b) 5 \quad (c) x = 5 \text{ or } x = -5$$

$$\boxed{2} / 2$$

- 27 $f(x) = 3x^2 + 9$
 $g(x) = 5x + 6$
 Find an expression for $gf(x)$.
 Give your answer in its simplest form.

$$gf(x) = g(3x^2 + 9)$$

$$= 5(3x^2 + 9) + 6$$

$$= 15x^2 + 51$$

$$15x^2 + 51$$

$$\boxed{2} / 2$$

28 $f(x) = 12 \div (x - 3)$

(a) Find $f(9)$.

(b) Solve $f(x) = 12$.

$$f(9) = 12 \div 6 = 2$$

$$12 \div (x - 3) = 12$$

$$x - 3 = 1$$

(a) 2 (b) $x = 4$

2 / 2

29 $f(x) = 5x$

$g(x) = kx^2$ where k is a constant

Given that $fg(1) = 20$, work out the value of k .

$$g(1) = 1k$$

$$f(1k) = 5(k)$$

$$5(k) = 20$$

$k = 4$

2 / 2

30 $f(x) = 6x + 5$

$g(x) = x^2 + 10$

Solve $f(x) = g(x)$.

$$x^2 + 10 = 6x + 5$$

$$x^2 - 6x + 5 = 0$$

$$(x - 1)(x - 5) = 0$$

$x = 1$ or $x = 5$

2 / 2

- 31 $g(x) = x^3 - 8$
 (a) Find $g(2)$.
 (b) Find $g(-2)$.
 (c) Solve $g^{-1}(x) = 5$.

$$g(2) = 2^3 - 8 = 0$$

$$g(-2) = (-2)^3 - 8 = -16$$

$$g^{-1}(x) = 5 \text{ means } x = g(5)$$

$$g(5) = 5^3 - 8 = 117$$

$$(a) 0 \quad (b) -16 \quad (c) x = 117$$

2 / 2

- 32 $f(x) = 2x + 8$
 $g(x) = kx^2$ where k is a constant
 Given that $fg(2) = 40$, work out the value of k .

$$g(2) = 4k$$

$$f(4k) = 2(4k) + 8$$

$$2(4k) + 8 = 40$$

$$k = 4$$

2 / 2

- 33 $f(x) = 4x + 6$
 $g(x) = x^2 + 1$
 Solve $f(x) = g(x)$.

$$x^2 + 1 = 4x + 6$$

$$x^2 - 4x - 5 = 0$$

$$(x + 1)(x - 5) = 0$$

$$x = -1 \text{ or } x = 5$$

2 / 2

34 $g(x) = x^2 - 4$ for $x \geq 0$

(a) Find $g(8)$.

(b) Find $g(7)$.

(c) Solve $g^{-1}(x) = 3$.

$$g(8) = 8^2 - 4 = 60$$

$$g(7) = 7^2 - 4 = 45$$

$$g^{-1}(x) = 3 \text{ means } x = g(3)$$

$$g(3) = 3^2 - 4 = 5$$

$$(a) 60 \quad (b) 45 \quad (c) x = 5$$

$$\boxed{2} / 2$$

35 $f(x) = 5x - 3$

(a) Find $f^{-1}(x)$.

$g(x) = kx^2$ where k is a constant

(b) Given that $fg(2) = 12$, work out the value of k .

$$y = 5x - 3$$

$$x = 5y - 3$$

$$x + 3 = 5y$$

$$y = \frac{x+3}{5}$$

$$g(2) = 4k$$

$$f(4k) = 5(4k) - 3$$

$$20k - 3 = 12$$

$$20k = 15$$

$$(a) \frac{x+3}{5} \quad (b) k = \frac{3}{4}$$

$$\boxed{2} / 2$$

36 $f(x) = x^2 - 9$

(a) Find an expression for $f(x+1)$.

(b) Hence solve $f(x+1) = 0$.

$$f(x+1) = (x+1)^2 - 9$$

$$= x^2 + 2x - 8$$

$$(x+1)^2 = 9$$

$$x+1 = \pm 3$$

$$(a) x^2 + 2x - 8 \quad (b) x = -4 \text{ or } x = 2$$

$$\boxed{2} / 2$$

- 37 $f(x) = 5x - 3$
 $g(x) = kx^2$ where k is a constant
 Given that $gf(3) = 576$, work out the value of k .

$$\begin{aligned} f(3) &= 12 \\ g(12) &= k \times 12^2 \\ 576 &= 144k \end{aligned}$$

$$k = 4$$

2 / 2

- 38 $f(x) = -4x + 4$
 (a) Find $f^{-1}(x)$.
 $g(x) = kx^2$ where k is a constant
 (b) Given that $fg(1) = -20$, work out the value of k .

$$\begin{aligned} y &= -4x + 4 \\ x &= -4y + 4 \\ x - 4 &= -4y \\ y &= \frac{4-x}{4} \\ g(1) &= k \\ f(k) &= -4(k) + 4 \\ -4k + 4 &= -20 \\ -4k &= -24 \end{aligned}$$

$$(a) \frac{4-x}{4} \quad (b) k = 6$$

2 / 2

- 39 $f(x) = x^2 - 16$
 (a) Find an expression for $f(x + 4)$.
 (b) Hence solve $f(x + 4) = 0$.

$$\begin{aligned} f(x + 4) &= (x + 4)^2 - 16 \\ &= x^2 + 8x \\ (x + 4)^2 &= 16 \\ x + 4 &= \pm 4 \end{aligned}$$

$$(a) x^2 + 8x \quad (b) x = -8 \text{ or } x = 0$$

3 / 3

40 $f(x) = 5x - 6$

$g(x) = -x + 5$

Find $gf^{-1}(-11)$.

$f^{-1}(-11) = -1$ (since $f(-1) = -11$)

$g(-1) = 6$

6

3 / 3

41 $f(x) = -4x + 2$

$g(x) = -5x - 8$

(a) Find $gf(4)$.

(b) Find an expression for $f^{-1}(x)$.

(c) Solve $f(x) = g(x)$.

$f(4) = -14$

$g(-14) = -5(-14) - 8 = 62$

$y = -4x + 2$

$x = -4y + 2$

$x - 2 = -4y$

$y = \frac{2-x}{4}$

$f(x) = g(x): -4x + 2 = -5x - 8$

(a) 62 (b) $\frac{2-x}{4}$ (c) $x = -10$

3 / 3

42 $f(x) = -2x + 2$

$g(x) = x^2$

Solve $fg(x) = gf(x)$.

$fg(x) = -2x^2 + 2$

$gf(x) = 4x^2 - 8x + 4$

$-2x^2 + 2 = 4x^2 - 8x + 4$

$-6x^2 + 8x - 2 = 0$

$x = \frac{1}{3}$ or $x = 1$

3 / 3

43 $f(x) = -4x + 2$

$g(x) = 4x + 1$

Find $gf^{-1}(-10)$.

$f^{-1}(-10) = 3$ (since $f(3) = -10$)

$g(3) = 13$

13

3 / 3

44 $f(x) = -3x - 4$

$g(x) = -4x - 9$

(a) Find $gf(5)$.

(b) Find an expression for $f^{-1}(x)$.

(c) Solve $f(x) = g(x)$.

$f(5) = -19$

$g(-19) = -4(-19) - 9 = 67$

$y = -3x - 4$

$x = -3y - 4$

$x + 4 = -3y$

$y = \frac{-4-x}{3}$

$f(x) = g(x): -3x - 4 = -4x - 9$

(a) 67 (b) $\frac{-4-x}{3}$ (c) $x = -5$

3 / 3

45 $f(x) = -2x + 5$

$g(x) = -x - 8$

Solve $f^{-1}(x) = g^{-1}(x)$.

$f^{-1}(x) = \frac{5-x}{2}$

$g^{-1}(x) = -8 - x$

$\frac{5-x}{2} = -8 - x$

$x = -21$

3 / 3

46 $f(x) = 2x - 3$

$g(x) = 3x^2$

(a) Find an expression for $fg(x)$.(b) Find an expression for $gf(x)$.(c) Solve $fg(x) = gf(x)$.

$$fg(x) = f(3x^2) = 2(3x^2) - 3 = 6x^2 - 3$$

$$gf(x) = g(2x - 3) = 3(2x - 3)^2 = 12x^2 - 36x + 27$$

$$6x^2 - 3 = 12x^2 - 36x + 27$$

$$0 = 6x^2 - 36x + 30$$

$$(a) 6x^2 - 3 \quad (b) 12x^2 - 36x + 27 \quad (c) x = 1 \text{ or } x = 5$$

3

 / 3

47 $f(x) = x^2 - 14$ for $x \geq 0$

$g(x) = x + 6$

(a) Find an expression for $g^{-1}(x)$.(b) Find an expression for $f^{-1}(x)$.(c) Solve $f^{-1}(x) = g^{-1}(x)$.

$$g^{-1}(x) = x - 6$$

$$y = x^2 - 14$$

$$x = y^2 - 14$$

$$y^2 = x + 14$$

$$y = \sqrt{x + 14}$$

$$f^{-1}(x) = \sqrt{x + 14}$$

$$\sqrt{x + 14} = x - 6$$

$$x + 14 = (x - 6)^2$$

$$x + 14 = x^2 - 12x + 36$$

$$0 = x^2 - 13x + 22$$

$$(x - 11)(x - 2) = 0$$

$$x = 11 \text{ or } x = 2$$

check $x = 2$: $\sqrt{2 + 14} = 4$ but $2 - 6 = -4$ so reject 2

$$(a) x - 6 \quad (b) \sqrt{x + 14} \quad (c) x = 11$$

3

 / 3

48 $f(x) = x + 9$

$g(x) = -4x - 1$

Solve $f^{-1}(x) = g^{-1}(x)$.

$$f^{-1}(x) = x - 9$$

$$g^{-1}(x) = \frac{-1-x}{4}$$

$$x - 9 = \frac{-1-x}{4}$$

$$x = 7$$

3

 / 3

49 $f(x) = 3x + 1$

$g(x) = x^2$

(a) Find an expression for $fg(x)$.(b) Find an expression for $gf(x)$.(c) Solve $fg(x) = gf(x)$.

$$fg(x) = f(x^2) = 3(x^2) + 1 = 3x^2 + 1$$

$$gf(x) = g(3x + 1) = (3x + 1)^2 = 9x^2 + 6x + 1$$

$$3x^2 + 1 = 9x^2 + 6x + 1$$

$$0 = 6x^2 + 6x$$

$$(a) 3x^2 + 1 \quad (b) 9x^2 + 6x + 1$$

$$(c) x = -1 \text{ or } x = 0$$

3

 / 3

50 $f(x) = x^2 - 28$ for $x \geq 0$

$g(x) = x + 2$

(a) Find an expression for $g^{-1}(x)$.(b) Find an expression for $f^{-1}(x)$.(c) Solve $f^{-1}(x) = g^{-1}(x)$.

$$g^{-1}(x) = x - 2$$

$$y = x^2 - 28$$

$$x = y^2 - 28$$

$$y^2 = x + 28$$

$$y = \sqrt{x + 28}$$

$$f^{-1}(x) = \sqrt{x + 28}$$

$$\sqrt{x + 28} = x - 2$$

$$x + 28 = (x - 2)^2$$

$$x + 28 = x^2 - 4x + 4$$

$$0 = x^2 - 5x - 24$$

$$(x - 8)(x + 3) = 0$$

$$x = 8 \text{ or } x = -3$$

check $x = -3$: $\sqrt{-3 + 28} = 5$ but $-3 - 2 = -5$ so reject -3

$$(a) x - 2 \quad (b) \sqrt{x + 28} \quad (c) x = 8$$

3

 / 3