functions mappings and quadratics ANS

0 min
0 marks

1. (a)

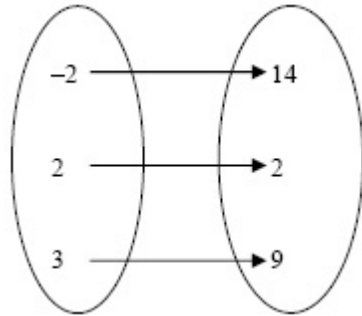|	$\mathbb{N}$	$\mathbb{Z}$	$\mathbb{Q}$	$\mathbb{R}$	
2	✓	✓	✓	✓	(A1)
$\sqrt{3}$	✗	✗	✗	✓	(A1)
$-\dfrac{2}{3}$	✗	✗	✓	✓	(A1)

Notes: Accept any symbol for ticks.
Do not penalize if the other boxes are left blank.   (C3)

(b) (i)

(A1)(A1)

Notes: Award (A1) for structure and layout of mapping diagram,
(A1) for correct values.   (C2)
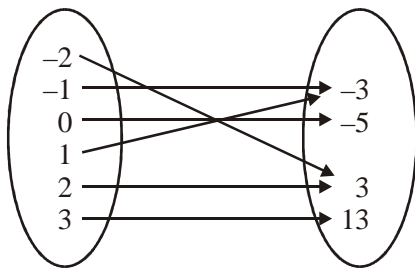
(ii) Range = {2, 9, 14}   (A1)(ft)

Note: Brackets not required.   (C1)

[6]

2. (a)

For six single lines going to correct y (y-value can be repeated)   (M1)
Correct diagram (y-values not repeated)   (A1) (C2)

(b) $x \in \{-2, -1, 0, 1, 2, 3\}$ (A2) (C2)

Note: Award (A1) if one value omitted.

(c) $y \in \{-3, -5, 3, 13\}$ (A2) (C2)

[6]

3. (a) $f(-2) = 2 \times 3^{-2}$ (M1)

$\qquad = \dfrac{2}{9}$ (0.222)   (A1)

$\qquad f(5) = 2 \times 3^5$

$\qquad\qquad = 486$ (A1)

Range $\dfrac{2}{9} \leq f(x) \leq 486$ **OR** $\left[\dfrac{2}{9}, 486\right]$ (A1) (C4)

> ***Note:*** *Award (M1) for correct substitution of –2 or 5 into f(x),*
> *(A1)(A1) for each correct end point.*

(b) $2 \times 3^x = 162$ (M1)

$\qquad x = 4$ (A1) (C2)

[6]

4. (a) Domain $x < 3$ (accept $-4 \leq x < 3$)   Range $y \leq 2$ (accept $-2 \leq y \leq 2$) (A2)(A2) (C4)

> ***Note:*** *Award (A1) for x $\leq$ 3 and (A1) for y < 2. If the domain*
> *and range are reversed award [0 marks] in this part of the*
> *question. Allow for other notation such as [$-\infty$, 3] or [∞, 3] for*
> *domain and [$-\infty$, 2] for range.*

(b) Domain $\{-3, -2, -1, 0, 1, 2, 3\}$ Range $\{1, 2, 3, 4\}$ (A2)(A2) (C4)

> ***Note:*** *Award (A2) ft, (A2) ft if domain and range are reversed.*
> *Award (A1) if 1 number is omitted from the domain and (A1) if*
> *1 number is omitted from the range.*
> *Award (A0) if more than 1 number is omitted from the domain*
> *and (A0) if more than 1 number is omitted from the range.*
> *Award (A0) for –3 $\leq$ x $\leq$ 3 and 1 $\leq$ y $\leq$ 4.*

[8]

5.

Equation	Diagram number	
$y = c$	2	(A2)
$y = -x + c$	3	(A2)
$y = 3x + c$	4	(A2)
$y = \dfrac{1}{3}x + c$	1	(A2) (C8)

[8]

6. (a) $x^2 - 5x + 6 = 0$
$(x - 2)(x - 3) = 0$ (A1)
$x = 2$ (A1)
$x = 3$ (A1)

(b) (2, 0)
(3, 0) (A1)

        Notes: *Follow through from part (a). Both must be correct and*
        written as coordinates for (A1)

[4]

7. (a) $(x + 2)(x - 4)$ (A1)

(b) (i) (–2, 0) (A1)

    (ii) (1, –9) (A1)(A1)

[4]

8. (a) (ii) (A2) (C2)

(b) (i) (A2) (C2)

(c) (iii) (A2) (C2)

(d) (iv) (A2) (C2)

[8]

9. (a)

(0, 5)
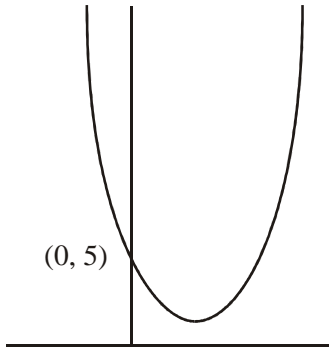
(A3) (C3)

Notes: Award (A1) for point (0,5) indicated.
Award (A2) for correct shape.

(b)   (1.5, 0.5)   (A1)(A1) (C2)

(c) $x = 1.5$ (A1) (C1)

[6]

10. (a) $y = x(5 - x)$ or $y = 5x - x^2$ or $25 = c + 5k$ (M1)
          $c = 0, k = 5$ (A1)(A1) (C3)

                Note: *Award (A1) if no method is indicated but c = 0 or k = 5*
                is given alone.

(b)   Vertex at $x = \dfrac{-b}{2a} = \dfrac{-5}{-2} = 2.5$ (M1)(A1)

      $y = 5(2.5) - 2.5^2 = 6.25$ (M1)(A1)

                Note: *The substitutions must be attempted to receive the*
                method marks.

      Q(2.5, 6.25)   (A1) (C5)

                Notes: *Coordinate pair is required for (A1) but Q is not*
                essential. If no working shown and answer not fully correct,
                award (G2) for each correct value and (A1) for coordinate
                brackets. However, if values are close but not exactly correct
                (eg (2.49, 6.25)) award only (G1) for each less precise value.
                In this case AP might also apply if number of digits is
                inappropriate.
                If differentiation is used, award (M1) for correct process, (A1)
                for x = 2.5, (M1)(A1) or (G2) for 6.25 and (A1) for coordinate
                brackets.

[8]

11. (a) $5x(6 – x)$ (A1)(A1)(A1)   (C3)

> *Note: Award (A1) for each factor. Therefore x(30 – 5x) would be awarded (A0)(A1)(A1).*

(b) $5x(6 – x) = 0$ (M1)
      $x = 0$ or $x = 6$
      $A = (6, 0)$ (A1)(A1)   (C3)

(c) $x = 3$ (A2)   (C2)

      OR

$$x = \frac{-b}{2a} = \frac{-30}{2 \times -5} \quad\quad\quad\quad\quad\quad\quad\quad \text{(M1)}$$

        $= 3$ (A1)   (C2)

[8]

12.

equation	sketch	
(i)	2	(A2)
(ii)	4	(A2)
(iii)	3	(A2)
(iv)	1	(A2) (C8)

> *Note: Award (A2) for each correct sketch.*

[8]

13. (a)   At $x = 0$ we have $y = 6 = c$,   (M1)
      so $c = 6$.   (A1)   (C2)

(b)   At $x = 3$ we have $9a + 12 + c = 0$ (M2)
      $a = -2$ (A1)

      OR

      at $x = -1$ we have $a - 4 + c = 0$ (M2)
      $a = -2$ (A1)   (C3)

(c)   Factorisation is $y = -2(x - 3)(x + 1)$ (A1)(A1)(A1)   (C3)

      OR

      can include 2 and/or sign in a factor.   (A1)(A2)   (C3)

[8]

14. (a) Put $x = 0$ to find $y = -2$ (M1)

Coordinates are $(0, -2)$ (A1) (C2)

> *Note: Award (M1)(A0) for –2 if working is shown. If not, award (M0)(A0).*

(b) Factorise fully, $y = (x - 2)(x + 1)$. (A1)(A1)

$y = 0$ when $x = -1, 2$. (A1)(A1)

Coordinates are A$(-1, 0)$, B$(2, 0)$. (A1)(A1) (C6)

> *Note: Award (C2) for each correct x value if no method shown and full coordinates not given. If the quadratic formula is used correctly award (M1)(A1)(A1)(A1)(A1)(A1). If the formula is incorrect award only the last (A1)(A1) as ft.*

[8]