

**Answers-Functions Review Packet from November Questions**

1. (a) (i) Domain:  $\mathbb{R}$  (A2)  
(ii) Range:  $\{y \mid y \geq 2\}$  accept  $y \geq 2$  (A2) (C4)
- (b) (i) Domain:  $\{x \mid -360^\circ \leq x \leq 360^\circ\}$  (A2)  
Accept  $-360 \leq x \leq 360$   
(ii) Range:  $\{y \mid -1.5 \leq y \leq 1.5\}$  (A2) (C4)  
Accept  $-1.5 \leq y \leq 1.5$

[8]

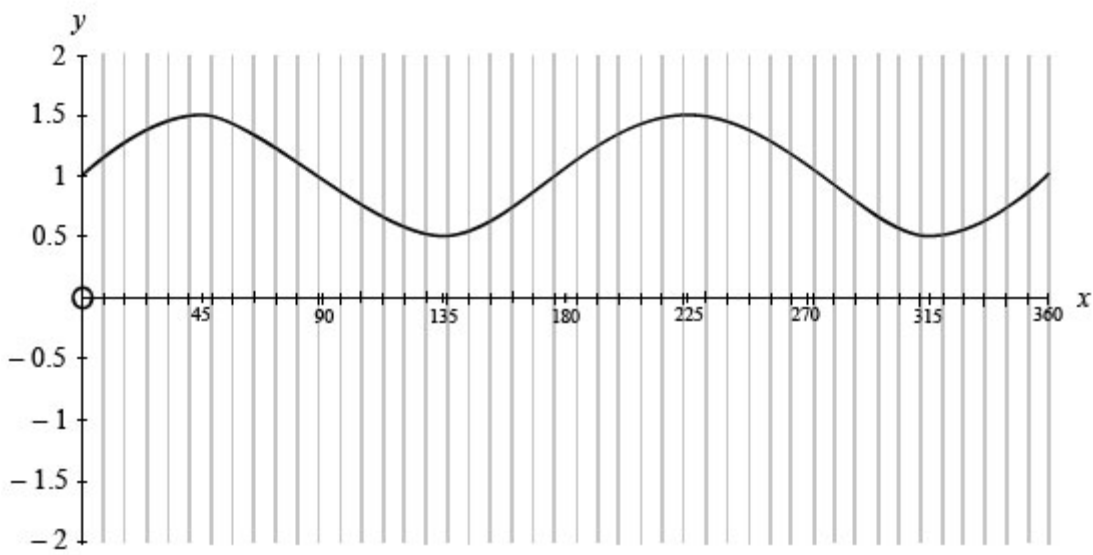
2. (a)  $p = -2$  (A1)  
 $q = 4$  (A1) (C2)
- (b) (i) domain = all real numbers except  $x = 2$  (A1)(A1) (C2)  
*Note: (A1) for  $\mathbb{R}$ , (A1) for except  $x = 2$ , (or equivalent notation)*
- (ii) range  $g(x) > 0$  (accept  $y > 0$ ) (A1)  
**OR**  
 $(0, \infty)$  (A1)  
**OR**  
 $0, \infty$  (A1) (C1)  
*Note: Accept  $0 < y \leq \infty$*
- (iii)  $x = 2$  (A1) (C1)  
*Note: must be an equation with  $x$*

[6]

3. (i) B (A1)  
(ii) D (A1)  
(iii) A (A1)  
(iv) E (A1)  
(v) C (A1)  
(vi) F (A1) (C6)

[6]

4. (a)



(A4)(C4)

*Notes:* (A1) for correct y-intercept  
 (A1) for correct minimum points  
 (A1) for correct maximum points  
 (A1) for smooth sine curve.

(b) period =  $180^\circ$  (A1)(ft) (C1)

(c) amplitude =  $\frac{1}{2}$  (A1)(ft) (C1)

[6]

5. (a) A = (0, 1)  
 For parentheses (A1)  
 For numbers (A1) 2

(b) B = (2, 4), C = (4, 16)  
 For 2,4 (A1)  
 For 4,16 (A1) 2

(c) At D,  $x = -0.767$  (A1) 1

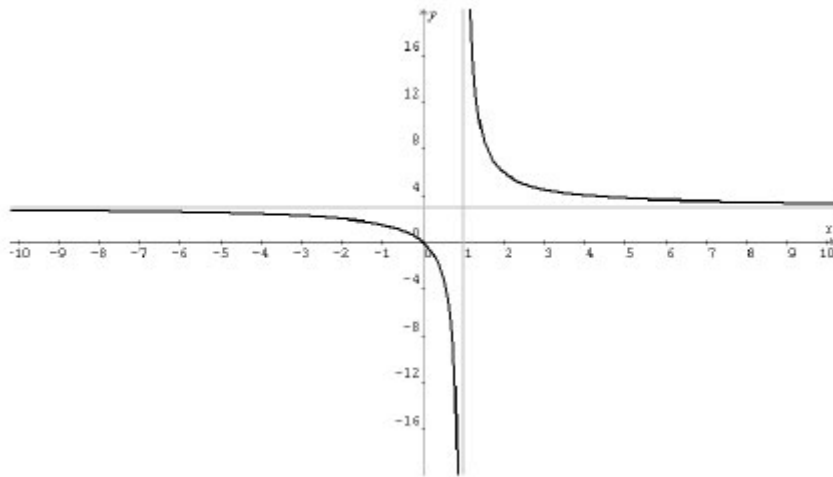
(d)  $x \leq -0.767$  (A1)  
 $2 \leq x \leq 4$  (A1)  
 For inequalities (A1)  
 For numbers (A1)

OR

$[-\infty, -0.767] \cup [2, 4]$  (A3) 3

[8]

6. (a)



(A4) (C4)

**Note:** Award (A1) for some indication of scale on the y-axis. Award (A1) for at least one asymptote drawn. Award (A1) for each of the two (smooth) branches. The left hand branch must pass through 0. One branch should be above the horizontal asymptote and the other below but if the asymptote is not drawn, then there should be little or no overlap in heights of the branches. If this condition is not fulfilled, award (A1)(A0) for the curve.

- (b) (i) Horizontal asymptote  $y = 3$  (A1)  
(ii) Vertical asymptote  $x = 1$  (A1)(ft) (C2)  
Equations for  $x$  and  $y$  must be seen, (ft) if reversed.

[6]

7. (a)  $x = -3$  (M1)(A1) (C2)  
**Note:** Award (M1) for using property of symmetry or sketch.

- (b) (i)  $f(-1) = 5$  (A1) (C1)  
(ii) Range =  $(-\infty, 5]$  or  $y \leq 5$  (A1)(A1)(A1) (C3)  
**Notes:** Award (A1) for “ $-\infty$ ”, (A1) for “ $]$ ”, (A1) for 5.  
For  $y = 5$  award (A1) only.  
For  $y < 5$  award (A1)(A1).

[6]

8. (a) A(-1.79, 0.789) and B(1.14, 2.70) (C2) (C2)  
**Notes:** Award (C2) for each pair of coordinates obtained from the GDC  
Award (A1)(A2)(ft) if bracket is not used.

- (b)  $-1.79 < x < 1.14$  (A1)(ft)(A1)(ft) (C2)  
**Note:** Award (A1) for both numbers, (A1) for correct inequalities.

[6]

9. (a) 2 (A1) (C1)

(b) 18 (A1) (C1)

(c)  $6 \leq t \leq 12$  (A1)(A1) (C2)

*Notes: Award (A1) for both numbers correct, (A1) for inequality signs.*

*Award (A1) for "from 6 to 12".*

(d)  $360 / b = 24$  (M1)

$b = 15$  (A1)

**OR**

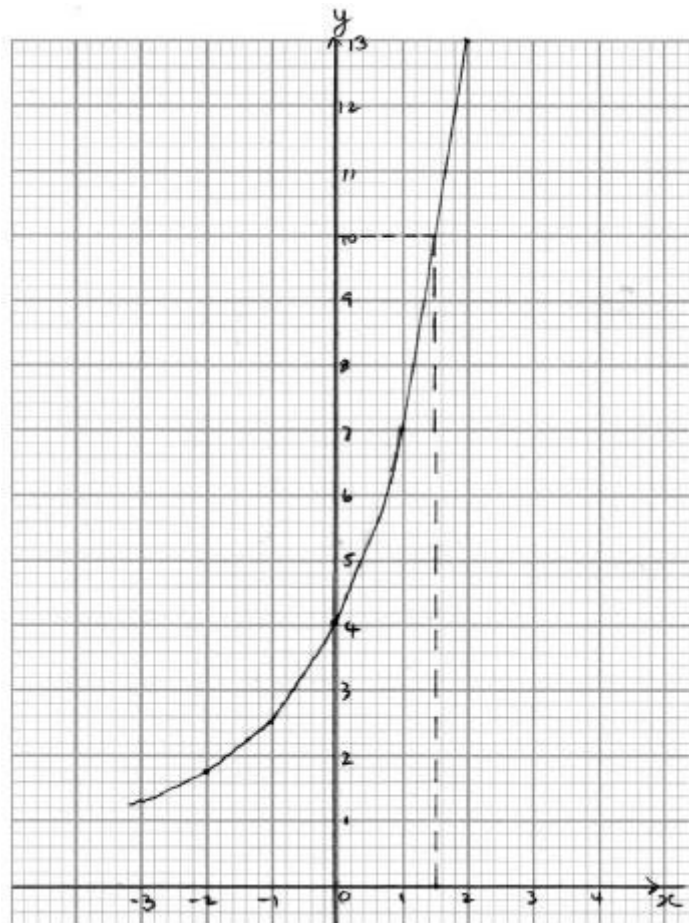
*Substituting into the equation of the function the coordinates of any point on the graph* (M1)

$b = 15$  (A1) (C2)

[6]

10. (a)  $a = 2.5, b = 13$  (A1)(A1) 2

(b) (A4) 4



*Note: Award (A1) for scales and labels, (A2) for all points accurate ((A1) for 5 correct), (A1) for smooth curve.*

- (c) Range  $f(x) > 1$   
 $(y > 1)$  (A2) 2

*Note: Award (A1) for  $f(x) >$ , (A1) for 1.*

- (d)  $x = 1.6 (\pm 0.1)$  (M1)(A1) (or (G2)) 2

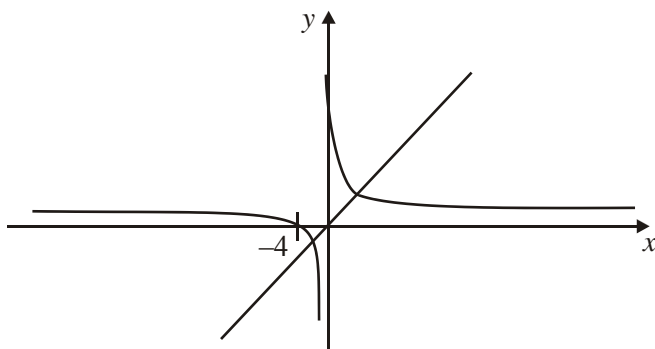
*Note: Answer by calculation is 1.58.*

[10]

11.  $a = 5$  (A2)  
 $b = 2$  (A2)  
 $c = 3$  (A2)

[6]

12. (a)



- For  $x$ -axis from  $-10$  to  $10$ . (A1)  
 For  $-4$  marked. (A1)  
 For correct shape of graph. (A1)(A1) 4

- (b) Horizontal asymptote  $y = 1$  (A1)  
 Vertical asymptote  $x = 0$  (A1) 4

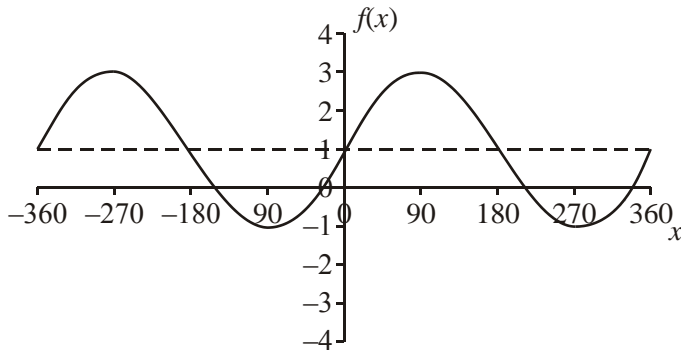
- (c) Line drawn on sketch (A2) 2

- (d)  $(2.56, 2.56) (-1.56, -1.56)$  (A1)(A1)(A1)(A1) 4

- (e) Range  $y \in \mathbb{R}, y \neq 1$  (A1)(A1) 2

[16]

13. (a)



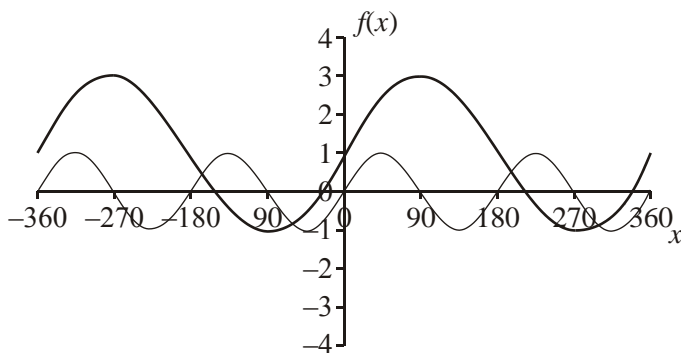
- $x$ -axis from  $-360^\circ$  to  $360^\circ$  (A1) 4
- 2 maxima at  $y = 3$  (A1)
- 2 minima at  $y = -1$  (A1)
- Correct shape of graph with reasonable axes intercepts. (A1)

(b) Range  $-1 \leq y \leq 3$  or  $[-1, 3]$  (A2) 2

*Note: Award (A1) for  $-1$  to  $3$ .*

(c) Amplitude = 2 (A1) 1

(d)



- Correct maximum (A1) 4
- Correct minimum (A1)
- Correct period (A1)
- Correct shape with reasonable axes intercepts. (A1)

(e) Period  $180^\circ$  (A1) 1

(f) 4 solutions (A1) 1

(g)  $x = 195^\circ$  (G2)  
 $x = 296^\circ$  (G2) 4

*Note: If more than two solutions given award (A2).*

[17]

14. (a) (i)  $\{-3, -2, -1, 0, 1, 2, 3\}$  (A1)(A1)

*Notes: Award (A1) for set brackets.  
Award (A1) for all and only correct numbers.*

(ii)  $\{0, 1, 4, 9\}$  (A1)

*Notes: Award (A1) for all and only correct numbers.  
If domain and range reversed, can follow through in (ii).*

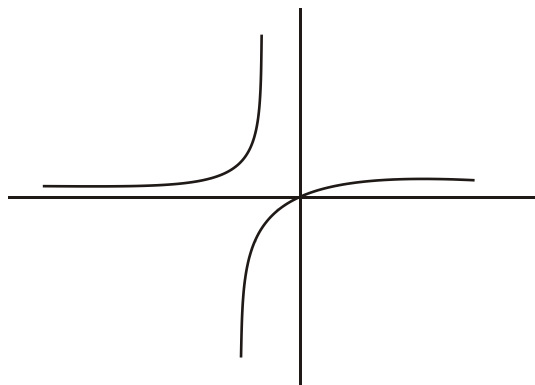
(iii)  $f(x) = x^2$  (A2) (C5)

*Note: Allow any other rule that works.*

(b)  $[1, \infty]$  or  $\{x \in \mathbb{R} \mid x \geq 1\}$  (A1) (C1)

[6]

15. (a)



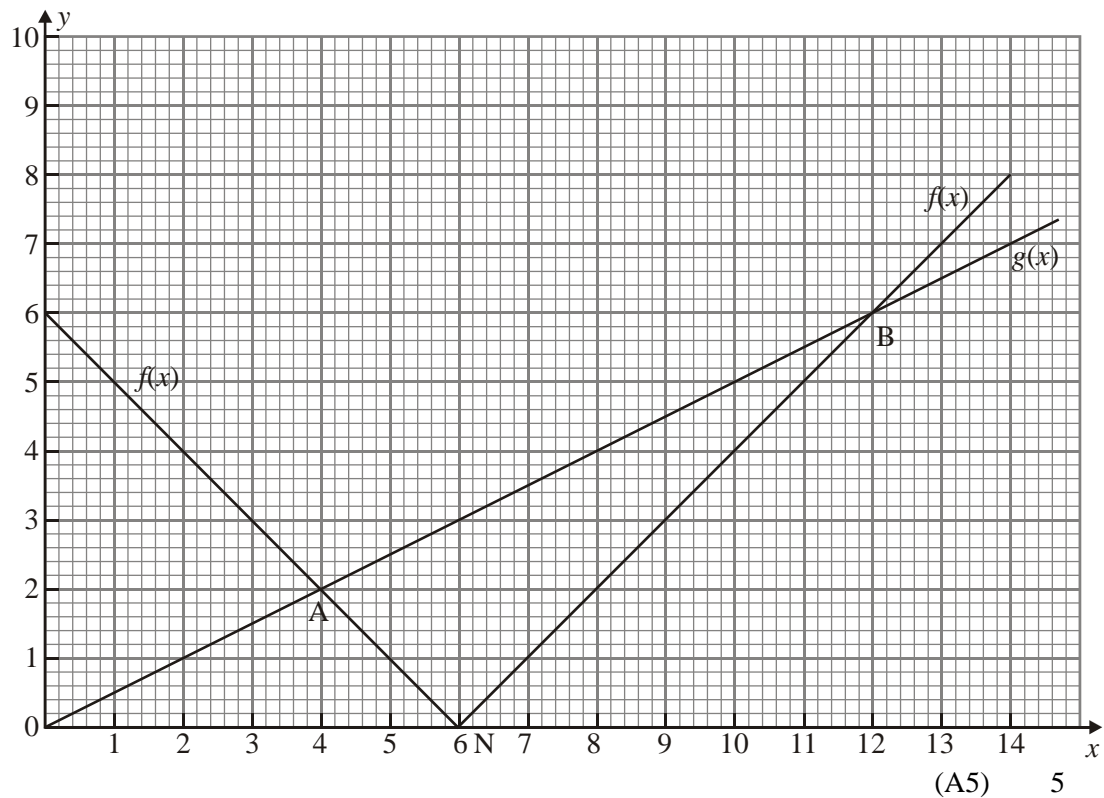
(A4) (C4)

*Notes: Award (A1) for correct scales.  
Award (A1)(A1) for two correct parts to the graph.  
Award (A1) if asymptotes are shown.*

(b) Horizontal asymptote  $y = 1$ . (A1) (C1)

[6]

16. (a)



*Note: Award (A1) for a correctly labelled graph, (A1) for correct scales, (A1) for line  $f(x) = 6 - x$  drawn correctly, (A1) for line  $f(x) = x - 6$  drawn correctly, (A1) for  $g(x) = \frac{1}{2}x$  drawn correctly.*

- (b) (i) Points named on the graph (A and B can be inversed) (A1)  
 (ii) A(4, 2), B(12, 6) (A1)(A1) 3

(c) Midpoint =  $\left(\frac{12+4}{2}, \frac{6+2}{2}\right)$  (M1)  
 = (8, 4) (A1) 2

*Note: Allow (A2) for reading from the graph but both coordinates must be correct.*

(d) Gradient =  $\frac{4-0}{8-6} = 2$  (A1)  
 $y = mx + c$   
 $0 = 2 \times 6 + c$  (M1)  
 $c = -12$  (A1)  
 Equation is  $y = 2x - 12$  (or correct alternatives).  
**Ft** from candidate's previous work. (A1) 4

[14]



17. (a) (i)  $120^\circ$  (A2) (C2)  
(ii) 1 (A2) (C2)  
(iii) 1 (A2) (C2)

(b)  $\frac{360}{a} = 120 \Rightarrow a = 3$  (A2) (C2)

[8]

18. (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  $[\infty, 3]$  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]

19. (a) The area covered before 7 July (R2) 2

*Note: Award (R1) for "area", (R1) for "before" 7 July.*

(b)  $t = 8 \pm 0.4$  (A1) 1

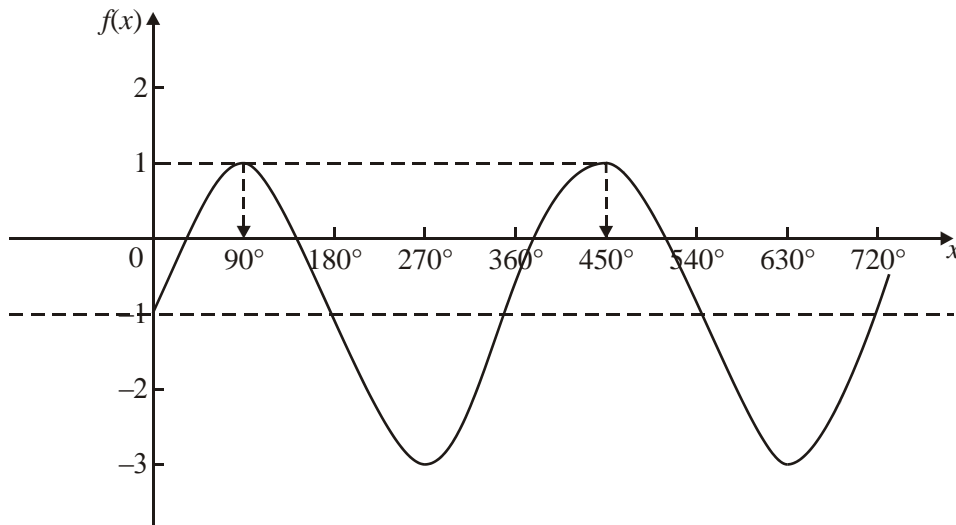
(c)  $100(1.075)^{21}$  (M1)(A1)  
 $= 457 \text{ m}^2$  (A1) 3

[6]

*Note: Award (M1) for correct formula, (A1) for correct power and (A1) for correct answer.*

20. (a)  $360^\circ$  (A1) (C1)  
 (b)  $-2 - 1 = -3$  (M1)(A1)(A1) (C3)

(c)



$x = 90^\circ, x = 450^\circ$

(G2)(G2)(C2)(C2)

**OR**

$$2 \sin x - 1 = 1$$

(M1)

$$2 \sin x = 2$$

$$\sin x = 1$$

(A1)

$$x = 90^\circ, 450^\circ$$

(A1)(A1)(C2)(C2)

*Notes: Award (C2) for  $x = 90^\circ$  with no working shown.*

*Answers given in radians*

*Award (A0) for (a)  $2\pi$ .*

*Award (M1)(A1)(A1)(A1)ft for (c)  $\frac{\pi}{2}, \frac{5\pi}{2}$ .*

[8]

21. (a) (iv) (A2) (C2)  
 (b) (i) (A2) (C2)  
 (c) (ii) (A2) (C2)  
 (d) (v) (A2) (C2)

[8]

22. (a) (0,1) (A2)(A2) (C4)  
 (b)  $16 = a^4$  (M2)  
 $a = 2$  (A2) (C4)

[8]

23.  $c = -10$  (asymptote of graph) (M1)(A1)  
 $0 = k(2^1) - 10 \Rightarrow 2k = 10$  (M1)  
 $\Rightarrow k = 5$  (A1)  
 OR  
 $k + c = -5$  (M1)  
 $2k + c = 0$  (M1)  
 Therefore,  $k = 5$  (A1)  
 $c = -10$  (A1)

[4]

24. (a)  $c = 1$  (A1) (C1)  
 (b) amplitude =  $\frac{4+2}{2}$  (M1)  
 $= 3$  (A1)  
 The graph of  $y = \sin x^\circ$  has been reflected in a line parallel to the  $x$ -axis therefore  $a = -3$  (A1) (C3)

[4]

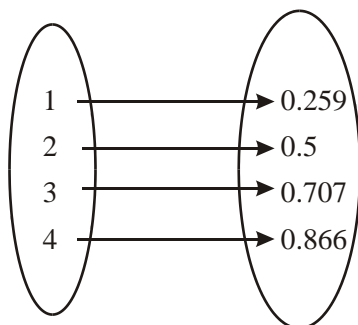
25. (a)  $\mathbb{R}^+$  (A1)  
 (b)  $P(0, 1)$  (A1)  
 (c) Decreases towards 0 *or*  $\rightarrow 0$  (A1)(A1)

*Note: Award (A1) for 'Decrease', and (A1) for  $\rightarrow 0$ .  
 Marks awarded at examiner's discretion.*

[4]

26. (a)  $f: x \mapsto 3x - 2$  (A1)  
 $x \in \{-1, 0, 1, 2, 3\}$  (A1)

(b)



(A2)

*Note: Award (A1) for the correct domain, (A1) for the correct range.*

[4]

27. (a)  $y = x^2 + 3$  (A1)  
(b)  $y = (x - 2)^2$  (A1)  
(c)  $y = (x - 2)^2 + 3$  (A2) 4

[4]