MARKING SCHEME 1

1. 25M.1.SL.TZ1.1

[[N/A]]

(a)

$$\ln 3 + \ln 4$$

[1]

Markscheme
$\ln 12$ ***A1*** ***[1 mark]***

(b)

$$3\ln 2$$

[2]

Markscheme
$\ln 2^3$ ***(A1)*** $= \ln 8$ ***A1*** ***[2 marks]***

(c)

$$-\ln \frac{1}{2}$$

[2]

Markscheme
$\ln \left(\frac{1}{2}\right)^{-1}$ **OR** $-(\ln 1 - \ln 2)$ **OR** $-\ln 2^{-1}$ ***(A1)*** $= \ln 2$ ***A1*** ***[2 marks]***

2. 25M.1.SL.TZ1.2

[5]

Markscheme
$f'(x) = 4x^2 - 16$ ***A1***   sets their derivative equal to zero ***(M1)*** $4x^2 - 16 = 0$, $(x = \pm 2)$ $p = 2$ (accept $x = 2$) ***A1***   substitutes their **positive** p into $f(x)$ ***(M1)*** $y = \frac{4(2^3)}{3} - 16(2) \left(= \frac{32}{3} - 32 = -\frac{64}{3}\right)$ $q = -\frac{64}{3}$ (accept $y = \frac{-64}{3}$) ***A1***   ***[5 marks]***

3. 25M.1.SL.TZ1.3

(a)

Write down the value of k.

[1]

Markscheme
$k = \frac{4}{400} \left(= \frac{1}{100} = 0.01\right)$ ***A1***   ***[1 mark]***

(b)

Expand and simplify $(1 + x)^4$.

[2]

Markscheme
attempt to find binomial coefficients or multiply out brackets ***(M1)*** e.g. Pascal's triangle down to correct row **OR** $(1 + 2x + x^2)^2$ **OR** substitute into binomial expansion $(1 + x)^4 = 1 + 4x + 6x^2 + 4x^3 + x^4$ ***A1***

[2 marks]

(c)

Hence or otherwise, find the amount of money in the account after one complete year, giving your answer correct to the nearest dinar.

[4]

Markscheme

METHOD 1 recognition that the expansion can be used with x replaced with k ***(M1)*** $\left(1+\frac{1}{100}\right)^4 = 1+\frac{4}{100}+\frac{6}{100^2}+\ldots(=1+0.04+0.0006+\ldots)$ ***(A1)***

multiplies by $1\,000$ (seen anywhere) ***(M1)*** $1\,000\left(1+\frac{1}{100}\right)^4$ $1\,000 + 40 + 0.6 + \ldots (= 1\,040.6\ldots) = 1\,041$ (dinar) ***A1*** **METHOD 2** attempt to find the value of $(1+k)^4$ by hand ***(M1)*** $(1.01)^4 = (1.0201)(1.01)^2 = (1.030301)(1.01) = 1.0406\ldots$ ***(A1)***

multiplies by $1\,000$ (seen anywhere) ***(M1)*** $1\,000(1.01)^4 = 1\,040.6\ldots = 1\,041$ (dinar) ***A1***
[4 marks]

4. 25M.1.SL.TZ1.4

[4]

Markscheme

METHOD 1 attempt to set up integral $e^x - (-e^x) = 2e^x$ or $2e^x$ and then double ***(M1)*** $\int\left(e^x - (-e^x)\right)dx$ **OR** $2\int e^x dx = 2\int_{-1}^{1} e^x\,dx = 2[e^x]_{-1}^{1}$ ***(A1)*** attempt to substitute correct limits into their integrated function and subtract ***(M1)*** $= 2\left(e-\frac{1}{e}\right),\ 2e-\frac{2}{e},\ 2e - 2e^{-1}$ ***A1*** **METHOD 2** $\int_{-1}^{1} e^x\,dx = [e^x]_{-1}^{1}$ and $\int_{-1}^{1} -e^x dx = [-e^x]_{-1}^{1}$ ***(A1)*** attempt to substitute correct limits into both their integrated functions and subtract ***(M1)*** $e^1 - e^{-1}$ and $-e^1 - (-e^{-1})$ subtracts their two integrals in correct order ***(M1)*** $e^1 - e^{-1} - (-e^1 + e^{-1}) = 2\left(e-\frac{1}{e}\right),\ 2e-\frac{2}{e},\ 2e-2e^{-1}$ ***A1***

[4 marks]

5. 25M.1.SL.TZ1.5

(a)

Find $P\,(A \cap B)$.

[3]

Markscheme

$P\,(A) = \frac{1}{4}$ ***(A1)*** attempt to use $P\,(B\ \ A) = \frac{P\,(B \cap A)}{P\,(A)}$ ***(M1)*** $\frac{2}{3} = \frac{P\,(B \cap A)}{\left(\frac{1}{4}\right)}$
$P\,(A \cap B) = \frac{2}{3}\left(\frac{1}{4}\right) = \frac{2}{12}\left(= \frac{1}{6}\right)$ ***A1***
[3 marks]

(b)

Show that events A and B are independent.

[3]

Markscheme

attempt to use $P\,(A \cup B) = P\,(A) + P\,(B) - P\,(A \cap B)$ **OR** a Venn diagram, with their values of $P\,(A)$ and $P\,(B \cap A)$ ***M1*** $\frac{3}{4} = \frac{1}{4} + P\,(B) - \frac{1}{6}$
$P\,(B) = \frac{1}{2} + \frac{1}{6} = \frac{4}{6}\left(= \frac{2}{3}\right)$ ***A1*** $P\,(B\ \ A) = P\,(B)$ **OR** $P\,(A)P\,(B) = \frac{1}{6}$ so $P\,(A \cap B) = P\,(A)P\,(B)$ (hence A and B are independent) ***R1*** **Note:** The ***R1*** is dependent on all previous marks.
[3 marks]

6. 25M.1.SL.TZ2.1

(a)

Find $f'(1)$.

[2]

Markscheme
attempt to differentiate (at least one correct term seen) ***(M1)*** $f'(x) = 3x^2 + 10x$ $3 + 10$ $f'(1) = 13$ ***A1*** ***[2 marks]***

(b)

Find the equation of the tangent to the graph of f at $x = 1$.

[2]

Markscheme
attempt to find $f(1)$ ***(M1)*** $1 + 5 - 8\ \ (= -2)$ $y + 2 = 13\,(x - 1)$ **OR** $y = 13x - 15$ ***A1*** ***[2 marks]***

7. 25M.1.SL.TZ2.2

[5]

Markscheme
recognises to integrate $g'(x)$ ***(M1)*** $\int g'(x)dx$ **OR** $\int(\cos x + e^{2x})dx$ $g(x) = \sin x + \frac{1}{2}e^{2x}(+C)$ ***A1A1*** substitutes $(0{,}7)$ into their integrated expression (must involve $+C$) ***(M1)*** $g\,(0) = 0 + \frac{1}{2} + C = 7 \Rightarrow C = 6.5$ $g\,(x) = \sin x + \frac{1}{2}e^{2x} + 6.5$ ***A1*** ***[5 marks]***

8. 25M.1.SL.TZ2.3

[[N/A]]

(a)

Write down the value of $f(0)$.

[1]

Markscheme
-2 (accept $(0, -2)$) ***A1*** ***[1 mark]***

(b)

Write down the equation of the horizontal asymptote.

[1]

Markscheme
$y = \frac{3}{2}$ (must be an equation) ***A1*** **Note:** Do not accept ≠ sign. ***[1 mark]***

(c)

Find the range of g.

[3]

Markscheme
attempt to reflect the graph of f in the x-axis **OR** one correct value seen ***(M1)*** both correct values $-\frac{3}{2}$ and 2 (seen anywhere) ***A1*** $-\frac{3}{2} < y \leq 2$ ***A1*** ***[3 marks]***

9. 25M.1.SL.TZ2.4

(a)

Using the sine rule, show that $\cos\theta = \frac{3\sqrt{2}}{5}$.

[3]

Markscheme
correct substitution in sine rule ***(A1)*** $\frac{\sin\theta}{5} = \frac{\sin 2\theta}{6\sqrt{2}}$ (or equivalent) attempt to use double angle rule for $\sin 2\theta$ ***(M1)*** $\frac{\sin\theta}{5} = \frac{2\sin\theta\cos\theta}{6\sqrt{2}}$ $6\sqrt{2}\sin\theta = 10\sin\theta\cos\theta$ **OR** $\frac{1}{5} = \frac{2\cos\theta}{6\sqrt{2}}$ **OR** equivalent ***A1*** $\cos\theta = \frac{3\sqrt{2}}{5}$ ***AG*** ***[3 marks]***

(b)

Hence, find $\sin\theta$.

[2]

Markscheme
valid attempt to find $\sin\theta$ ***(M1)*** $\sin^2\theta + \left(\frac{3\sqrt{2}}{5}\right)^2 = 1$ **OR** right triangle with adjacent side and hypotenuse labelled $\sin\theta = \frac{\sqrt{7}}{5}$ ***A1*** ***[2 marks]***

(c)

Find DC.

[2]

Markscheme
$\frac{1}{2} \times 6\sqrt{2} \times DC \times \frac{\sqrt{7}}{5} = 2\sqrt{14}$ ***(A1)*** $DC = \frac{10}{3}$ ***A1*** ***[2 marks]***

10. 25M.1.SL.TZ3.3

(a)

Write down the value of $f(-3)$.

[1]

Markscheme
$f(-3) = -1$ ***A1***   ***[1 mark]***

(b)

State the domain of f^{-1}, the inverse function of f.

[1]

Markscheme
$-3 \leq x \leq 5$ ***A1*** **Note:** Award ***A1*** for answers using interval notation $[-3,\ 5]$.   ***[1 mark]***

(c)

Find the value of x that satisfies $f^{-1}(2x-7) = -3$.

[3]

Markscheme
$(f^{-1}(2x-7) = -3 \Rightarrow)\, 2x - 7 = f(-3)$ **OR** $f^{-1}(-1) = -3$ ***(M1)*** $2x - 7 = -1$ ***(A1)*** $x = 3$ ***A1***   ***[3 marks]***

11. 24N.1.SL.TZ1.1

(a)

Write down

[[N/A]]

(a.i)

the mode;

[1]

Markscheme
27 ***A1*** ***[1 mark]***

(a.ii)

the range;

[1]

Markscheme
30 ***A1*** ***[1 mark]***

(a.iii)

the median.

[1]

Markscheme
35 ***A1*** ***[1 mark]***

(b)

Find the interquartile range.

[3]

Markscheme
$Q_1 = 31$ and $Q_3 = 46$ ***(A1)*** attempt to subtract their upper and lower quartiles ***(M1)*** **Note:** Award ***M1*** only for correct values, or for values clearly indicated as candidate's Q_1 and Q_3. $46 - 31$ IQR $= 15$ ***A1*** ***[3 marks]***

12. 24N.1.SL.TZ1.2

(a)

Find the value of r.

[3]

Markscheme
$\frac{1}{2}r^2(\theta) = 6$ OR $\frac{1}{2}r^2(0.75) = 6$ ***(A1)*** attempt to solve their equation to find r or r^2 ***(M1)*** **Note:** To award the ***M1***, candidate's equation must include r^2 and $\theta = 1.5$, and they must isolate r^2 or r. $r^2 = 16$ $r = 4$ (cm) ***A1*** ***[3 marks]***

(b)

Hence, find the perimeter of sector OAB.

[2]

Markscheme
evidence of summing the two radii and the arc length ***(M1)*** perimeter $= 2r + r\theta = 8 + 4(0.75) = 11$ (cm) ***A1*** ***[2 marks]***

13. 24N.1.SL.TZ1.4

[4]

Markscheme
METHOD 1 attempt to expand $(2n+5)^2-(2n-5)^2$ ***M1*** **Note:** Award ***M0*** for invalid attempts such as $(2n+5)^2=4n^2+25$. $=4n^2+20n+25-(4n^2-20n+25)$ or equivalent ***A1*** $=40n$ OR $20n+20n$ ***A1*** $=10(4n)$ OR $\frac{40}{10}=4$ OR $\frac{40n}{4}=10n$ OR $20n+20n=10(2n+2n)$ (or equivalent) ***R1*** so is a multiple of 10 ***AG*** **Note:** Do not award the ***R1*** unless both ***A*** marks have been awarded. **METHOD 2** use of $a^2-b^2=(a+b)(a-b)$ where $a=2n+5,\ b=2n-5$ ***M1*** $=(2n+5+2n-5)(2n+5-2n+5)$ ***A1A1*** **Note:** Award ***A1*** for each correct bracket. $=4n\times 10\ \ (=40n)$ ***R1*** so is a multiple of 10 ***AG*** **Note:** Do not award the ***R1*** unless both ***A*** marks have been awarded. ***[4 marks]***

14. 24M.1.SL.TZ1.1

(a)

Find the value of the common difference.

[2]

Markscheme
valid method to find the common difference ***(M1)*** $d=\frac{22-10}{2}$ OR $10+2d=22$ OR $u_1+d=10,\ u_1+3d=22$ OR $u_3=16$ $d=6$ ***A1*** ***[2 marks]***

(b)

Find an expression for u_n, the $n\ th$ term.

[2]

Markscheme
$u_1=10-6(=4)$ ***(A1)*** $u_n=4+6(n-1)$ OR $u_n=6n-2$ ***A1*** ***[2 marks]***

15. 24M.1.SL.TZ1.2

(a)

Find the value of p and the value of q.

[5]

Markscheme
attempt to form equation for the sum of frequencies$=16$ or mean$=3$ ***(M1)*** $p+q+4+2+3=16(\Rightarrow p+q=7)$ ***A1*** $\frac{p+2q+12+8+18}{16}=3(\Rightarrow p+2q=10)$ OR $\frac{p+2q+12+8+18}{9+p+q}=3(\Rightarrow 2p+q=11)$ ***A1*** attempt to eliminate one variable from their equations ***(M1)*** $p+2(7-p)+38=48$ OR $2(7-q)+q=11$ $p=4$ and $q=3$ ***A1*** **Note:** Award ***M1A0A0M0A1*** for $p=4,\ q=3$ with no working. ***[5 marks]***

(b)

Write down the mean final score.

[1]

Markscheme
mean final score $=30$ ***A1*** ***[1 mark]***

16. 24M.1.SL.TZ2.1

(a)

Write down the value of

[[N/A]]

(a.i)

$f(4)$;

[1]

Markscheme
$f(4) = 1$ ***A1***   ***[1 mark]***

(a.ii)

$f \circ f(4)$;

[1]

Markscheme
$f \circ f(4) = 3$ ***A1***   ***[1 mark]***

(a.iii)

$f^{-1}(3)$.

[1]

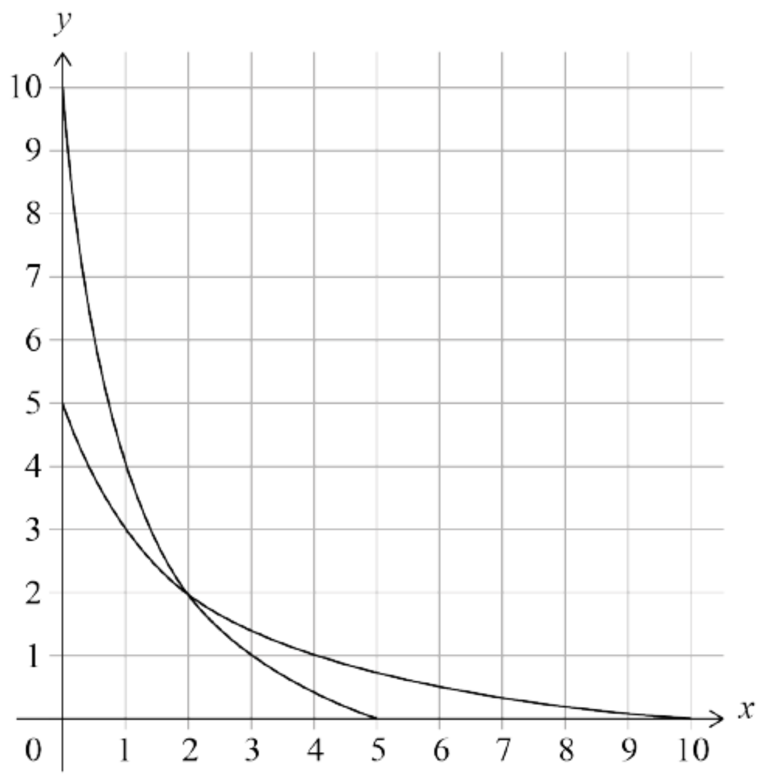
Markscheme
$f^{-1}(3) = 1$ ***A1***   ***[1 mark]***

(b)

On the axes above, sketch the graph of $y = f^{-1}(x)$. Show clearly where the graph intercepts the axes.

[2]

Markscheme



concave up curve with y intercept at $(0,\ 10)$ and x intercept at $(5,\ 0)$ ***A1*** curve passes through $(2,\ 2)$ OR through $(1,\ 4)$ and $(3,\ 1)$ ***A1*** **Note:** Do not award the second mark unless the first mark has been awarded. (Do not award ***A0A1***).

[2 marks]

17. 24M.1.SL.TZ2.3

(a)

Solve $3m^2 + 5m - 2 = 0$.

[3]

Markscheme

valid attempt to solve a quadratic equation (factorising, use of formula, completing square, or otherwise) ***(M1)*** $(3m - 1)(m + 2) = 0$ OR $m = \frac{-5 \pm \sqrt{25+24}}{6}$ (or equivalent) ***(A1)*** $m = \frac{1}{3},\ m = -2$ ***A1***

[3 marks]

(b)

Hence or otherwise, solve $3 \times 9^x + 5 \times 3^x - 2 = 0$.

[2]

Markscheme
setting their m-value(s) $= 3^x$ OR recognising a quadratic in 3^x ***(M1)*** $3^x = \frac{1}{3}$ (or $3^x = -2$) OR $3 \times (3^x)^2 + 5 \times 3^x - 2 = 0$ $x = -1$ ***A1*** **Note:** Award the final ***A1*** if candidate's answer includes $x = -1$ and $x = \log_3(-2)$. Award ***A0*** if other incorrect answers are given. ***[2 marks]***

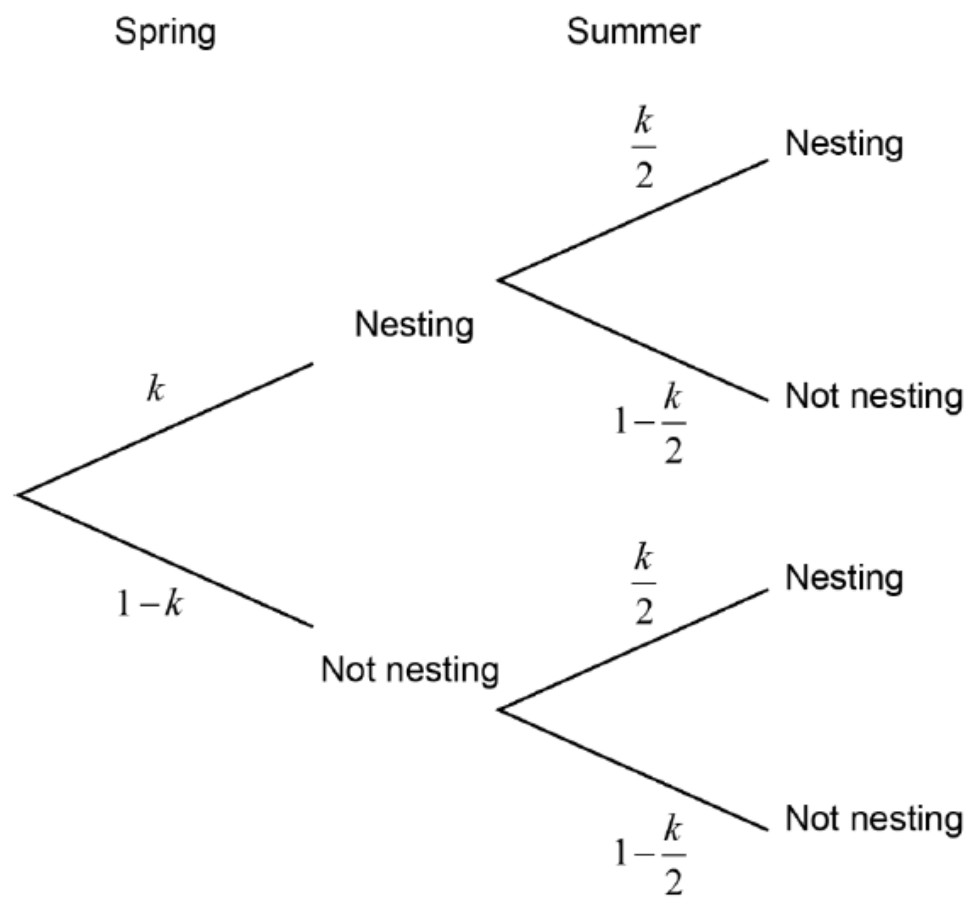
18. 24M.1.SL.TZ2.5

(a)

Complete the tree diagram to show the probabilities of not nesting in each season. Write your answers in terms of k.

[2]

Markscheme



$1-k$ for Spring ***A1*** $1-\frac{k}{2}$ for both Summers ***A1***
[2 marks]

(b.i)

Show that $9k^2 - 27k + 8 = 0$.

[3]

Markscheme
multiplying the two correct branches ***(A1)*** $(1-k)\left(1-\frac{k}{2}\right)$ attempt to expand and equate to $\frac{5}{9}$ ***(M1)*** $1-k-\frac{k}{2}+\frac{k^2}{2}=\frac{5}{9}$ $18-18k-9k+9k^2=10$ OR $\frac{k^2}{2}-\frac{3k}{2}+\frac{4}{9}=0$ OR $\frac{9k^2}{2}-\frac{27k}{2}+4=0$ ***A1*** $9k^2-27k+8=0$ ***AG***   ***[3 marks]***

(b.ii)

Both $k = \frac{1}{3}$ and $k = \frac{8}{3}$ satisfy $9k^2 - 27k + 8 = 0$.

State why $k = \frac{1}{3}$ is the only valid solution.

[1]

Markscheme
($k = \frac{1}{3}$ is the only valid solution as) $\frac{8}{3} > 1$ ***R1*** **Note:** Accept any valid reasoning indicating that any probability cannot be greater than 1 and/or probability cannot be less than 0. ***[1 mark]***

19. 23N.1.SL.TZ1.1

[[N/A]]

(a)

Write down the value of a.

[1]

Markscheme
$a = 7$ ***A1*** ***[1 mark]***

(b.i)

Write down the period of f.

[1]

Markscheme

period = π ***A1***
[1 marks]

(b.ii)

Hence, find the value of b.

[2]

Markscheme
$b = \frac{2\pi}{\pi}$ OR $\pi = \frac{2\pi}{b}$ ***(A1)*** $= 2$ ***A1***   ***[2 marks]***

(c)

Find the value of $f\left(\frac{\pi}{12}\right)$.

[3]

Markscheme
substituting $\frac{\pi}{12}$ into their $f(x)$ ***(M1)*** $f\left(\frac{\pi}{12}\right) = 7\sin\left(\frac{\pi}{6}\right)\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$ ***(A1)*** $= \frac{7}{2}$ **A1**   ***[3 marks]***

20. 23N.1.SL.TZ1.3

[[N/A]]

(a)

Find $P(A \cup B)$.

[2]

Markscheme

$(P(A \cup B) =)\ 0.7 + 0.75 - 0.55$ ***(A1)*** $= 0.9$ ***A1***
[2 marks]

(b)

Hence, otherwise find $P(A' \cap B')$.

[2]

Markscheme
recognition that $A' \cap B' = (A \cup B)'$ OR $A' \cap B' = 1 - A \cup B$ (region/value may be seen in a correctly shaded/labeled Venn diagram) ***(M1)*** $(= 1 - 0.9) = 0.1$ ***A1*** **Note:** For the final mark, 0.1 must be stated as the candidate's answer, or labeled as $P(A' \cap B')$ in their Venn diagram. Just seeing an unlabeled 0.1 in the correct region of their diagram earns ***M1A0***. ***[2 marks]***

21. 23M.1.SL.TZ1.1

(a)

Find the coordinates of M.

[2]

Markscheme
$M\ (6,\ -3)$ ***A1A1*** ***[2 marks]***

(b)

Find the gradient of L.

[2]

Markscheme

gradient of $[PQ] = -\frac{5}{9}$ ***(A1)*** gradient of $L = \frac{9}{5}$ ***A1*** ***[2 marks]***

(c)

Hence, write down the equation of L.

[1]

Markscheme
$y + 3 = \frac{9}{5}(x - 6)$ OR $y = \frac{9}{5}x - \frac{69}{5}$ (or equivalent) ***A1*** **Note:** Do not accept $L = \frac{9}{5}x - \frac{69}{5}$. ***[1 mark]***

22. 23M.1.SL.TZ1.2

[[N/A]]

(a)

Find the zero of $f(x)$.

[2]

Markscheme
recognizing $f(x) = 0$ ***(M1)*** $x = -1$ ***A1*** ***[2 marks]***

(b)

For the graph of $y = f(x)$, write down the equation of

[[N/A]]

(b.i)

the vertical asymptote;

[1]

Markscheme
$x = 2$ (must be an equation with x) ***A1 [1 mark]***

(b.ii)

the horizontal asymptote.

[1]

Markscheme
$y = \frac{7}{2}$ (must be an equation with y) ***A1 [1 mark]***

(c)

Find $f^{-1}(x)$, the inverse function of $f(x)$.

[3]

Markscheme
EITHER interchanging x and y ***(M1)*** $2xy - 4x = 7y + 7$ correct working with y terms on the same side: $2xy - 7y = 4x + 7$ ***(A1)*** **OR** $2yx - 4y = 7x + 7$ correct working with x terms on the same side: $2yx - 7x = 4y + 7$ ***(A1)*** interchanging x and y OR making x the subject $x = \frac{4y+7}{2y-7}$ ***(M1)*** **THEN** $f^{-1}(x) = \frac{4x+7}{2x-7}$ (or equivalent) $\left(x \neq \frac{7}{2}\right)$ ***A1 [3 marks]***

23. 23M.1.SL.TZ1.4

(a)

Show that the equation $\cos 2x = \sin x$ can be written in the form $2\sin^2 x + \sin x - 1 = 0$.

[1]

Markscheme
$1 - 2\sin^2 x = \sin x$ ***A1*** $2\sin^2 x + \sin x - 1 = 0$ ***AG [1 mark]***

(b)

Hence, solve $\cos 2x = \sin x$, where $-\pi \leq x \leq \pi$.

[5]

Markscheme
valid attempt to solve quadratic ***(M1)*** $(2\sin x - 1)(\sin x + 1)$ OR $\frac{-1 \pm \sqrt{1-4(2)(-1)}}{2(2)}$ recognition to solve for $\sin x$ ***(M1)*** $\sin x = \frac{1}{2}$ OR $\sin x = -1$ any correct solution from $\sin x = -1$ ***A1*** any correct solution from $\sin x = \frac{1}{2}$ ***A1*** **Note:** The previous two marks may be awarded for degree or radian values, irrespective of domain. $x = -\frac{\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$ ***A1*** **Note:** If no working shown, award no marks for a final value(s). Award ***A0*** for $-\frac{\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$ if additional values also given. ***[5 marks]***

24. 23M.1.SL.TZ1.5

[6]

Markscheme
recognition of quadratic in e^x ***(M1)*** $(e^x)^2 - 3e^x + \ln k (= 0)$ OR $A^2 - 3A + \ln k (= 0)$ recognizing discriminant ≥ 0 (seen anywhere) ***(M1)*** $(-3)^2 - 4(1)(\ln k)$ OR $9 - 4\ln k$ ***(A1)*** $\ln k \leq \frac{9}{4}$ ***(A1)*** $e^{9/4}$ (seen anywhere) ***A1*** $0 < k \leq e^{9/4}$ ***A1 [6 marks]***

25. 22M.1.SL.TZ1.2

(a)

The expression $\frac{3\sqrt{x}-5}{\sqrt{x}}$ can be written as $3 - 5x^p$. Write down the value of p.

[1]

Markscheme
$\frac{3\sqrt{x}-5}{\sqrt{x}} = 3 - 5x^{-\frac{1}{2}}$ ***A1*** $p = -\frac{1}{2}$ ***[1 mark]***

(b)

Hence, find the value of $\int_1^9 \left(\frac{3\sqrt{x}-5}{\sqrt{x}}\right) dx$.

[4]

Markscheme
$\int \frac{3\sqrt{x}-5}{\sqrt{x}} dx = 3x - 10x^{\frac{1}{2}}(+c)$ ***A1A1***   substituting limits into their integrated function and subtracting ***(M1)*** $3(9) - 10(9)^{\frac{1}{2}} - \left(3(1) - 10(1)^{\frac{1}{2}}\right)$ OR $27 - 10 \times 3 - (3 - 10)$ $= 4$ ***A1***   ***[4 marks]***

26. 22M.1.SL.TZ1.3

(a)

Find the largest value of c that would not be considered an outlier.

[3]

Markscheme

IQR $= 10 - 6 (= 4)$ ***(A1)***
attempt to find $Q_3 + 1.5 \times$ IQR ***(M1)***
$10 + 6$
16 ***A1***

[3 marks]

(b.i)

One of the adults surveyed is 42 years old. Estimate the age of their eldest child.

[2]

Markscheme
choosing $c = \frac{1}{2}a - 9$ ***(M1)*** $\frac{1}{2} \times 42 - 9$ $= 12$ (years old) ***A1***   ***[2 marks]***

(b.ii)

Find the mean age of all the adults surveyed.

[2]

Markscheme
attempt to solve system by substitution or elimination ***(M1)*** 34 (years old) ***A1***   ***[2 marks]***

27. 22M.1.SL.TZ1.5

[5]

Markscheme

evidence of using product rule *(M1)*

$\frac{dy}{dx} = (2x-1) \times (ke^{kx}) + 2 \times e^{kx}$ $\left(= e^{kx}(2kx - k + 2)\right)$ ***A1***

correct working for one of (seen anywhere) ***A1***

$\frac{dy}{dx}$ at $x = 1 \Rightarrow ke^k + 2e^k$

OR

slope of tangent is $5e^k$

their $\frac{dy}{dx}$ at $x = 1$ equals the *slope* of $y = 5e^k x$ $(= 5e^k)$ (seen anywhere) ***(M1)***

$$ke^k + 2e^k = 5e^k$$

$k = 3$ ***A1***

[5 marks]

28. 25M.2.SL.TZ1.1

(a)

Show that $\frac{(x-1)^2}{x} = x - 2 + \frac{1}{x}$.

[2]

Markscheme

METHOD 1 attempt to expand brackets on the numerator ***M1*** $(x-1)^2 = x^2 - 2x + 1$ $\frac{(x-1)^2}{x} = \frac{x^2-2x+1}{x}\left(= \frac{x^2}{x} - \frac{2x}{x} + \frac{1}{x}\right)$ ***A1*** $= x - 2 + \frac{1}{x}$ ***AG*** **METHOD 2** attempt to express terms with a common denominator ***M1*** $x - 2 + \frac{1}{x} = \frac{x^2}{x} - \frac{2x}{x} + \frac{1}{x} = \frac{x^2-2x+1}{x}$ ***A1*** $= \frac{(x-1)^2}{x}$ ***AG***

[2 marks]

(b)

Hence, find $\int f(x)\,dx$.

[3]

Markscheme
$\int f(x)\,dx = \frac{x^2}{2} - 2x + \ln\lvert x\rvert (+c)$ ***A1A1A1***   **Note:** Award ***A1*** for each correct term.   ***[3 marks]***

29. 25M.2.SL.TZ1.2

(a)

the area of the sector BOA;

[3]

Markscheme
EITHER $210° = \frac{210\pi}{180}\left(= \frac{7\pi}{6} = 3.66519\ldots\right)$ radians ***(A1)*** attempt to use radian formula for area of sector ***(M1)*** area $= \frac{1}{2}(19.5)^2\left(\frac{7\pi}{6}\right)$ **OR** attempt to use degree formula for area of sector ***(M1)*** area = $\frac{210}{360}\pi(19.5)^2$ ***(A1)***   **THEN** area $= \frac{3549\pi}{16} = 696.844.. = 697\left(= \frac{3549\pi}{16}\right)\ (cm^2)$ ***A1***   ***[3 marks]***

(b)

the radius of the cone.

[3]

Markscheme
EITHER arc length $= 19.5\left(\frac{7\pi}{6}\right)$ **OR** $= \frac{210}{360}\left(2\pi(19.5)\right)\left(= \frac{91\pi}{4} = 71.4712\ldots\right)$ ***(A1)*** attempt to set $2\pi r$ equal to arc length ***(M1)*** $2\pi r = 71.4712..$ **OR** attempt to set πrl equal to their area from

(a) ***(M1)*** $19.5\pi r = 696.844\ldots$ ***(A1)*** **THEN** $r = 11.4\left(= \frac{91}{8} = 11.375\right)\ (cm)$ ***A1***

[3 marks]

30. 25M.2.SL.TZ1.3

(a)

Write down the period of f.

[1]

Markscheme
period is $\frac{\pi}{2}(= 1.57079\ldots = 1.57)$ ***A1***   ***[1 mark]***

(b)

Find the value of a and the value of b.

[3]

Markscheme
attempt to substitute $x = \frac{\pi}{12},\ f(x) = 5$ and $x = \frac{\pi}{3}, f(x) = 7$ to obtain two equations ***(M1)***   **Note:** accept work where x values have been converted into degrees $a\tan\left(\frac{\pi}{6}\right) + b = 5$ and $a\tan\left(\frac{2\pi}{3}\right) + b = 7$ $\left(\Rightarrow \frac{a}{\sqrt{3}} + b = 5 \text{ and } -a\sqrt{3} + b = 7\right)$ $a = -\frac{\sqrt{3}}{2}(= -0.866025\ldots = -0.866)$ ***A1*** $b = \frac{11}{2}(= 5.5)$ ***A1***   **Note:** These ***A1*** marks may be awarded independently.   ***[3 marks]***

31. 25M.2.SL.TZ1.4

[6]

Markscheme
METHOD 1 attempt to find change in population using a definite integral ***(M1)*** $t = 4$ at the start of 2026 (seen anywhere) ***(A1)*** $\int_0^4 -104\,000e^{-0.0145t}dt$ ***(A1)*** $= -404165.8\ldots$ ***(A1)***   attempt to add initial population to their change in population from a definite integral ***(M1)*** population at the start of $2026 = 6.78 \times 10^6 - 404\,165.8\ldots = 6\,375\,834.1\ldots = 6\,380\,000\ (= 6.38 \times 10^6)$ ***A1*** **METHOD 2** attempt to find population using an indefinite integral ***(M1)*** $P = \int -104\,000e^{-0.0145t}dt\ \frac{-104\,000e^{-0.0145t}}{-0.0145} + c(= 7\,172\,413.7\ldots e^{-0.0145t} + c)$ ***(A1)***   attempt to substitute $t = 0,\ P = 6.78 \times 10^6$ into equation with c. ***(M1)*** $6.78 \times 10^6 = 7\,172\,413.7\ldots + c \Rightarrow c = -392\,413.7\ldots\ P = 7\,172\,413.7\ldots e^{-0.0145t} - 392\,413.7\ldots$ ***(A1)*** $t = 4$ at the start of 2026 (seen anywhere) ***(A1)***   population at the start of $2026 = 7\,172\,413.7\ldots e^{-0.0145(4)} - 392\,413.7\ldots = 6\,375\,834.1\ldots = 6\,380\,000(= 6.38 \times 10^6)$ ***A1***   ***[6 marks]***

32. 24N.2.SL.TZ1.1

[[N/A]]

(a)

Find the value of

[[N/A]]

(a.i)

$f(0)$;

[1]

Markscheme
$f(0) = -7$ ***A1***

[1 mark]

(a.ii)

$f(60)$.

[1]

Markscheme
$-12.7782\ldots$ $f(60) = -12.8$ $\left(= 7\sqrt{60} - 67 = 14\sqrt{15} - 67\right)$ ***A1***   ***[1 mark]***

(b)

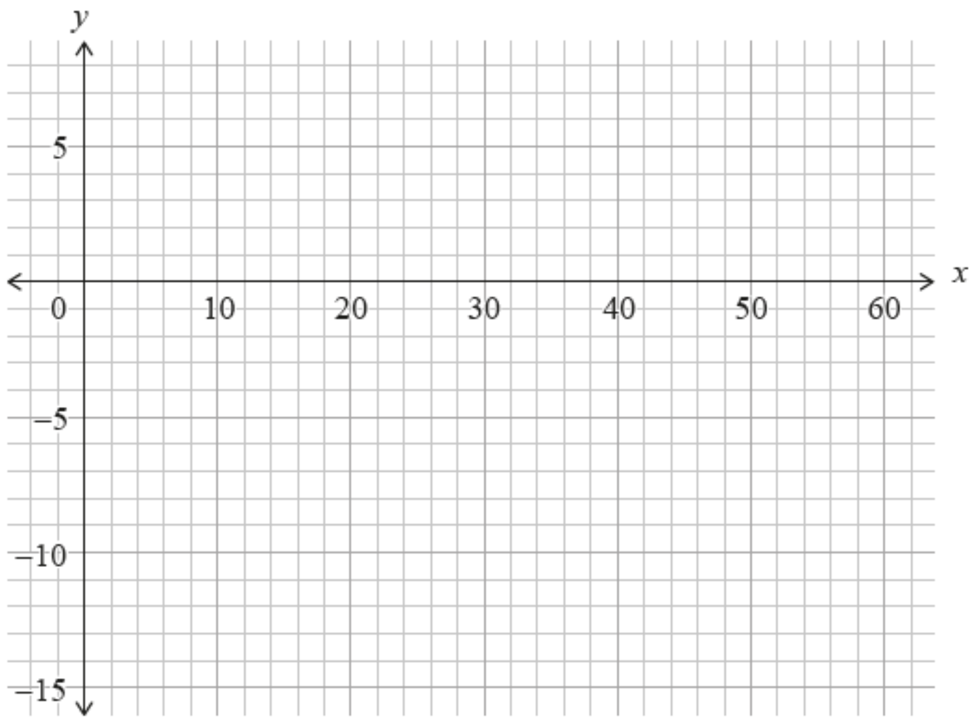
Find the two roots of $f(x) = 0$.

[2]

Markscheme
attempt to find at least one root ***(M1)*** $x = 1.46098\ldots$ and $x = 33.5390\ldots$ $x = 1.46$ and $x = 33.5$ ***A1***   ***[2 marks]***

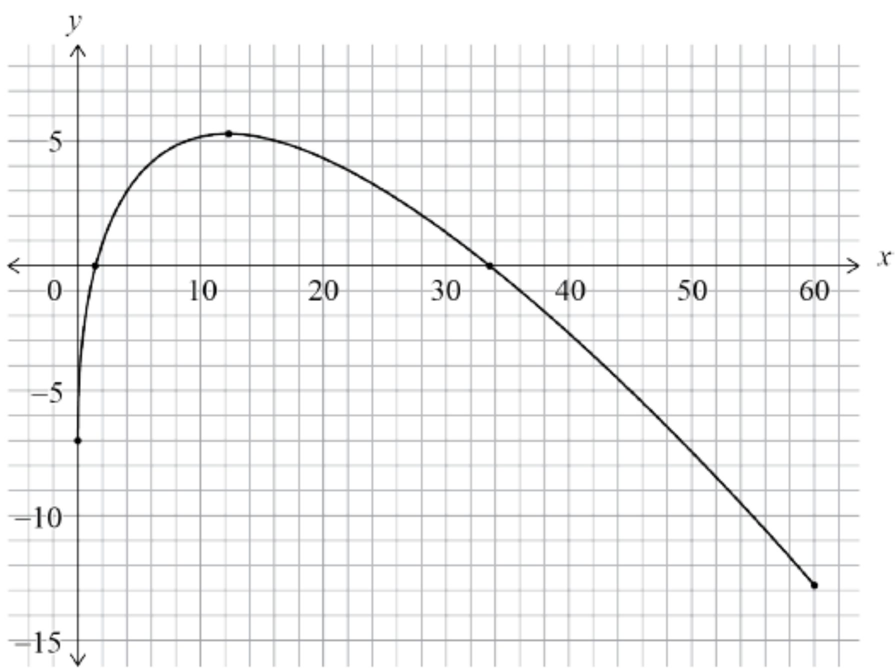
(c)

Sketch the graph of $y = f(x)$ on the following grid.



[3]

Markscheme



A1A1A1

Note: Follow through from their part (a). Award ***A1*** for endpoints at approximately $(0,\ 7)$ and $(60,\ -12.8)$. Allow for y-intercept $-8 < y < -6$ and for the right endpoint in the interval $x = 60,\ -13 < y < -12$. The following two ***A*** marks may only be awarded if the approximate shape is correct. Award ***A1*** for x-intercepts at approximately $x = 1.5$ and $x = 33.5$ and award ***A1*** for maximum at approximately $(12.2,\ 5.3)$. Allow for x-intercepts in the intervals $0 < x < 2,\ 32 < x < 34$, and maximum in the intervals $10 < x < 14,\ 4.5 < y < 6$.
[3 marks]

33. 24N.2.SL.TZ1.2

[4]

Markscheme

EITHER attempt to form a product of binomial coefficient, a power of $2x$ and a power of -5 seen ***(M1)***
$(2x)^8(-5)^3$ OR $(2x)^8(-5)^3$ OR $165 \times (2x)^8(-5)^3$. ***(A1)(A1)*** **Note**: Award ***A1*** for or or 165, ***A1*** for $(2x)^8(-5)^3$. **OR** attempt to use the general term ***(M1)*** $(2x)^{11-r}(-5)^r$ and $r = 3$ ***(A1)(A1)*** **THEN**
-5280000 (exact) ***A1*** **Note**: Award ***A0*** for a final answer of $-5280000x^8$.
[4 marks]

34. 24N.2.SL.TZ1.4

(a)

Find the value of k.

[2]

Markscheme

recognition of sum of probabilities equals 1 ***(M1)*** $\frac{2k}{15} + \frac{4k}{15} + \frac{7k}{15} + \frac{10k}{15} = 1$
$k = 0.652173 \ldots\ k = 0.652\ \left(= \frac{15}{23}\right)$ ***A1***
[2 marks]

(b)

Find $E(X)$.

[3]

Markscheme
correct probabilities: $\frac{2}{23}, \frac{4}{23}, \frac{7}{23}, \frac{10}{23}$ OR $0.0870,\ 0.174,\ 0.304,\ 0.435$ ***(A1)*** substitution of their probabilities into formula for expected value ***(M1)*** $2 \times \frac{2}{23} + 4 \times \frac{4}{23} + 7 \times \frac{7}{23} + 10 \times \frac{10}{23}$ OR $\frac{169k}{15} = 7.34782 \ldots E(X) = 7.35 \ \left(= \frac{169}{23}\right)$ (same 3sf from previous 3sf answer) ***A1***   ***[3 marks]***

35. 25M.2.SL.TZ3.4

(a.i)

Find the value of a.

[2]

Markscheme
summing probabilities and equating to 1 ***(M1)*** $1.5a + 2a + 0.281 + a + 0.026 = 1$ $(a =)$ 0.154 ***A1***   ***[2 marks]***

(a.ii)

Write down the mode of X.

[1]

Markscheme
2 (days) ***A1***   ***[1 mark]***

(b)

Find the mean of X.

[2]

Markscheme
using expected value formula ***(M1)*** (mean =) 2.44 $(2.436$ (exact)) ***A1***   ***[2 marks]***

(c)

Identify which one of the following best describes the manager's sampling method.

Circle your answer.

Simple random / Systematic / Convenience / Quota / Stratified

[1]

Markscheme
convenience (sampling) ***A1***   ***[1 mark]***

36. 24M.2.SL.TZ1.2

(a)

Find the value of the car at the end of the first year.

[2]

Markscheme
recognition that a $15\,\%$ loss leaves $85\,\%$ OR finding $15\,\%$ and subtracting from original ***(M1)*** $0.85 \times 35\,000$ OR $35\,000 - 0.15 \times 35\,000 =$ $(\$)29\,750$ ***A1*** **Note:** Accept $(\$)29\,800$.

[2 marks]

(b)

Find the value of Darren's car 10 years after he buys it, giving your answer to the nearest dollar.

[2]

Markscheme
EITHER $29\,750 \times 0.89^9$ ***(A1)*** **OR** $N = 9$ $I\,\% = -11$ $PV = \mp 29\,750$ ***(A1)*** **THEN** value $(FV) = (\$)10\,423$ ***A1*** **Note:** For this ***A1*** the answer must be rounded to the nearest dollar. Accept $(\$)10\,441$ from using 3 sf answer from part (a). ***[2 marks]***

(c)

Find the least value of n.

[3]

Markscheme
METHOD 1 attempt to solve the inequality (or equation) $29\,750 \times 0.89^{n-1} < 3500$ OR table of values ***(M1)*** 19.3643 ... OR $(n = 19 \Rightarrow)\, 3651.80$ ... OR $(n = 20 \Rightarrow)\, 3250.10$ ... ***(A1)*** **Note:** For candidates using $(\$)\, 29\,800,\ n > 19.3787 \ldots,\ (n = 19 \Rightarrow)\, 3657.93 \ldots,\ (n = 20 \Rightarrow)\, 3255.56 \ldots.$ $n = 20$ ***A1*** **METHOD 2** use of the finance app with $I\,\% = -11,\ PV = \mp 29\,750,\ FV = \pm 3500$ OR $29\,750 \times 0.89^N < 3500$ (condone the use of n or x) ***(M1)*** $(N =)18.3643$ ... ***(A1)*** **Note:** For candidates using $(\$)\, 29\,800,\ N = 18.3787 \ldots$ $n = 20$ ***A1*** ***[3 marks]***

37. 24M.2.SL.TZ1.4

(a)

Find the probability that X is more than 1.5 standard deviations above the mean.

[2]

Markscheme
recognition of $X > 13$ OR $Z > 1.5$ (could be seen in a diagram) ***(M1)*** $(P(X > 13) =)\ 0.0668072 \ldots = 0.0668$ ***A1*** ***[2 marks]***

(b)

Find the value of k.

[2]

Markscheme
EITHER equating an appropriate correct normal CDF function to 0.1 or 0.9 ***(M1)*** $P(X > 10 + 2k) = 0.1$ OR $P(Z < k) = 0.9$ OR $P(X < 10 - 2k) = 0.1$ OR $P(Z < -k) = 0.1$ **OR** recognising need to use inverse normal with 0.1 or 0.9 ***(M1)*** **THEN** $1.28155 \ldots\ k = 1.28$ ***A1*** ***[2 marks]***

38. 24M.2.SL.TZ1.5

(a)

Find the smallest value of t when the particle changes direction.

[2]

Markscheme
recognition that velocity is zero ***(M1)*** $v = 2\sin(0.5t) + 0.3t - 2 = 0$ $t = 1.68694 \ldots\ t = 1.69$ ***A1*** ***[2 marks]***

(b)

Find the range of values of t for which the velocity is positive.

[2]

Markscheme
$1.68694... < t < 6.11857...$ $1.69 < t < 6.12$ ***A1A1*** **Note:** Award ***A1*** for both values, ***A1*** for correct inequalities. ***[2 marks]***

(c)

Find the displacement of the particle relative to O when $t = 10$.

[2]

Markscheme
attempt to substitute into the total displacement formula (condone missing or incorrect limits, and absence of dt) ***(M1)*** $\int_0^{10}(2\sin(0.5t) + 0.3t - 2)\,dt$ OR $\int_0^{10} v(t)dt = -2.13464...$ $= -2.13\ (m)$ ***A1*** **Note:** Award ***(M1)A0*** if -2.13 is followed by 2.13. ***[2 marks]***

39. 24M.2.SL.TZ2.2

(a)

Find the value of a and the value of b.

[3]

Markscheme
attempts to find an intersection point ***(M1)*** $a = -0.916562...$ or $b = 0$ $a = -0.917,\ b = 0$ ***A1A1*** ***[3 marks]***

(b)

Find the area of the region enclosed by the graphs of f and g.

[3]

Markscheme

let A be the area of the region **EITHER** attempts to form the required integral involving subtraction (in any order). Accept absence of limits or incorrect limits. Accept absence of dx. ***(M1)*** **OR** shows a graph with the required area shaded ***(M1)*** **THEN** $A = \left(\int_a^b (f(x) - g(x))\, dx\right) = \int_{-0916562...}^{0} (1 - x^2 - e^{2x})\, dx$ (or equivalent) ***(A1)*** $A = 0.239855 \ldots$ $A = 0.240$ ***A1***
[3 marks]

40. 24M.2.SL.TZ2.3

(a)

Given that $\overline{x} = 7$, verify that $\overline{y} = 16$.

[1]

Markscheme

EITHER $\overline{y} = 2.1875 \times 7 + 0.6875$ ***A1*** **OR** $\overline{y} = 15.3125 + 0.6875$ ***A1*** **THEN** $\overline{y} = 16$ ***AG***
[1 mark]

(b)

Given that $q - p = 3$, find the value of p and the value of q.

[4]

Markscheme

attempts to use $16 = \frac{\Sigma y}{n}$ to form a linear equation in p and q ***(M1)*** $16 = \frac{9+13+p+q+21}{5}$ $(80 = p + q + 43 \Rightarrow p + q = 37)$ ***(A1)*** attempts to solve two linear equations simultaneously for p and q (one of which is $q = p +$

3) ***(M1)*** $16 = \frac{9+13+p+p+3+21}{5}$ $(80 = 2p + 46)$ $p = 17$ and $q =$
20 ***A1***
[4 marks]

41. 24M.2.SL.TZ2.4

(a)

State the intensity of S_2.

[1]

Markscheme

$I = 2 \times 10^{-6} \left(= \frac{1}{500\,000}\right)$ (units) ***A1***
[1 mark]

(b)

Determine the loudness of S_2.

[2]

Markscheme

substitutes their doubled I-value from part (a) into L ***(M1)*** $L =$
$10 \log_{10} (2 \times 10^{-6} \times 10^{12})(= 63.0102 \ldots) = 63.0$ (decibels) ***A1*** **Note:**
Accept $60 + 10 \log_{10} 2$ (decibels) as a final answer. Do not award the final
A1 for $L = 0$ (from $I = 10^{-12}$).
[2 marks]

(c)

Find the corresponding intensity, I, of the thunder.

[3]

Markscheme

$115 = 10\log_{10}(I \times 10^{12})$ ***(A1)*** attempts to solve for I ***(M1)*** $I = \frac{10^{11.5}}{10^{12}}$ (or equivalent) $(= 0.316227\ldots)$ $I = 0.316$ (units) ***A1*** **Note:** Accept exact final answers such as $10^{-0.5}$ and $\frac{1}{\sqrt{10}}$.
[3 marks]

42. 24M.2.SL.TZ2.5

(a)

Find the velocity of the particle at $t = 2$.

[1]

Markscheme

$v = -0.996114\ldots$ $v = -0.996$ (ms^{-1}) ***A1***
[1 mark]

(b)

Find the maximum velocity of the particle.

[2]

Markscheme

considers $v'(t) = 0$ ***(M1)*** $t = 0.405833\ldots$ $v_{\max} = 1.18230\ldots$ $v_{\max} = 1.18$ (ms^{-1}) ***A1***
[2 marks]

(c)

Find the acceleration of the particle at the instant it changes direction.

[3]

Markscheme

recognizes that the particle changes direction when $v = 0$ ***(M1)*** **Note:** Award ***(M1)*** for $t = 1.65840 \ldots$ seen. finds acceleration for their value of t for which $v(t) = 0$ ***(M1)*** $v'(1.65840 \ldots)$ $a = -2.53487 \ldots$ $a = -2.53$ (ms^{-2}) ***A1***
[3 marks]

43. 23N.2.SL.TZ1.2

(a)

Find BV.

[2]

Markscheme

$BV = \sqrt{(8-4)^2 \times (6-3)^2 + (0-10)^2}$ ***(A1)*** $= 11.1803 \ldots = 11.2 \left(= \sqrt{125} = 5\sqrt{5}\right)$ ***(A1)***
[2 marks]

(b)

Find the size of $B\hat{V}C$.

[4]

Markscheme

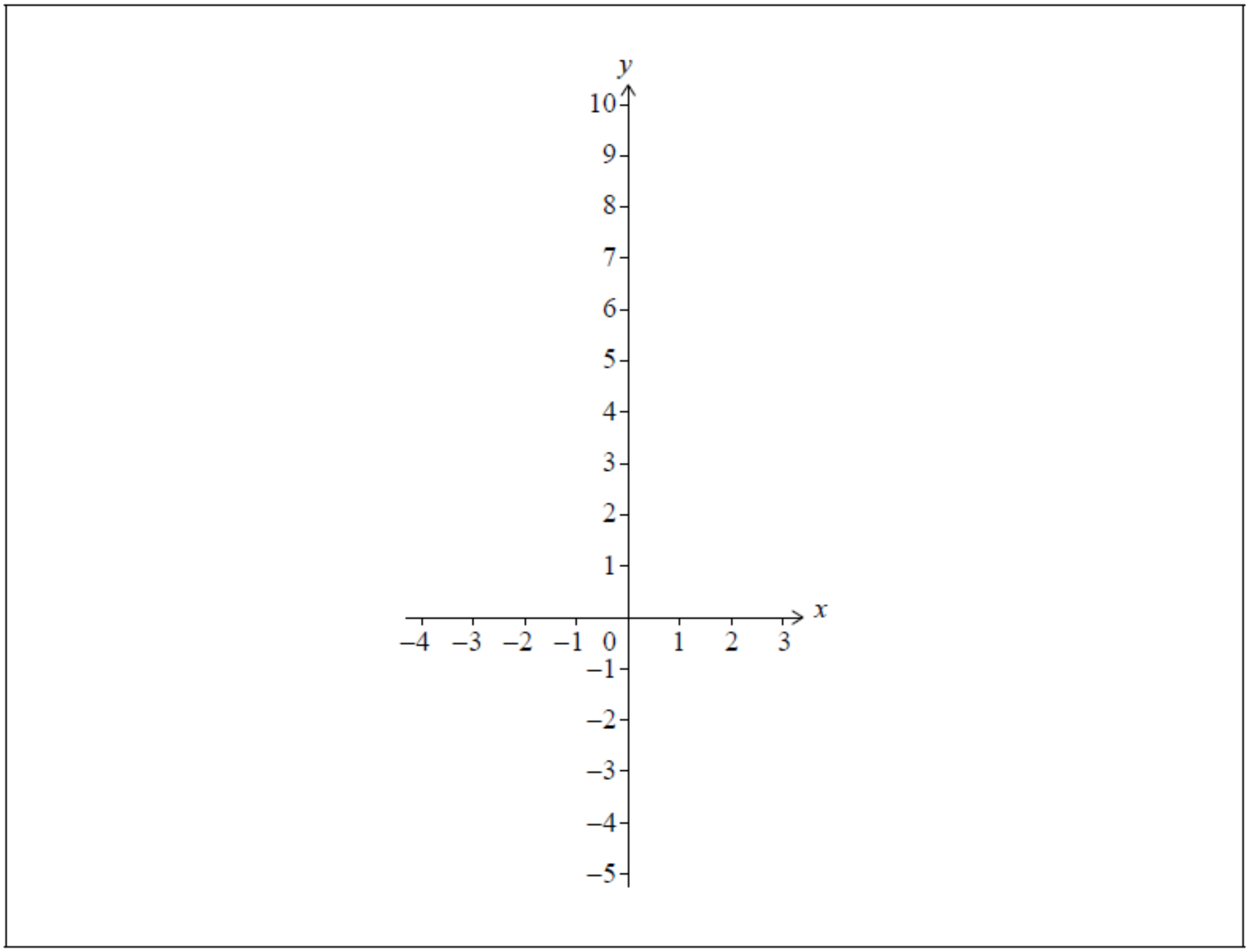
METHOD 1 $BV = VC$ AND $BC = 6$ (seen anywhere) ***(A1)*** attempt to use the cosine rule on triangle BVC for any angle ***(M1)*** **Note:** Recognition must be shown in context either in terms of labelled sides or side lengths. $cos B\hat{V}C = \frac{11.1\ldots^2 + 11.1\ldots^2 - 6^2}{2 \times 11.1\ldots \times 11.1\ldots}$ OR $6^2 = 11.1\ldots^2 + 11.1\ldots^2 - 2 \times 11.1\ldots \times 11.1\ldots cos B\hat{V}C$ ***(A1)*** $B\hat{V}C = 0.543314 \ldots$ $B\hat{V}C = 0.543$ (0.542 from 3 sf) (accept 31.1°) ***A1*** **METHOD 2** let M be the midpoint of BC BM = 3 (seen anywhere) ***(A1)*** attempt to use sine or cosine in triangle BMV or CMV ***(M1)*** $\arcsin \frac{3}{\sqrt{125}}$ OR $\frac{\pi}{2} - \arccos \frac{3}{\sqrt{125}}$ OR 0.271657… ***(A1)*** $B\hat{V}C = 0.543314 \ldots$ $B\hat{V}C = 0.543$ (0.542 from 3 sf) (accept 31.1°) ***A1***
[4 marks]

44. 23N.2.SL.TZ1.3

[[N/A]]

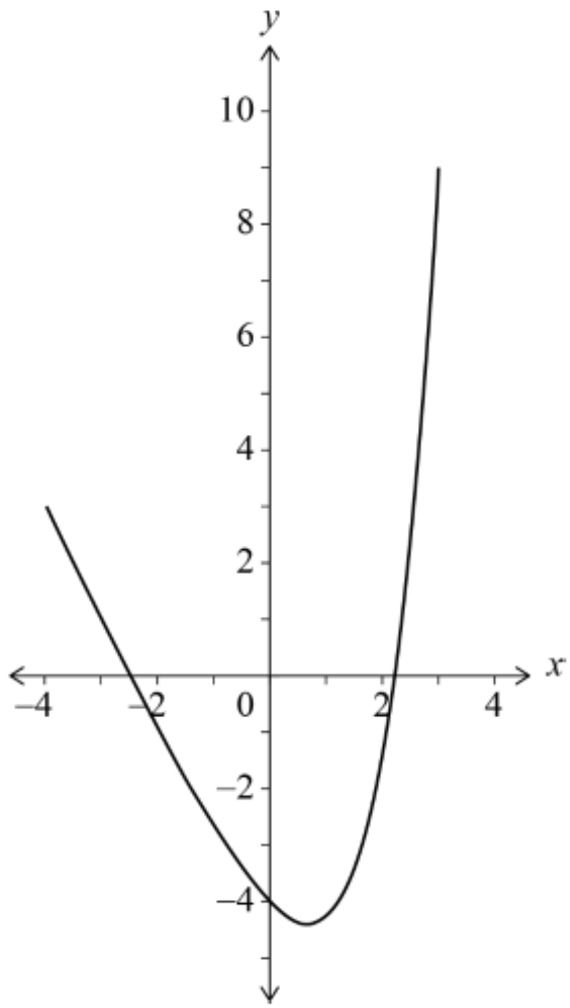
(a)

On the following axes, sketch the graph of f for $-4 \leq x \leq 3$.



[3]

Markscheme



A1A1A1

Note: Award marks as follows:
A1 for approximately correct roots, in the intervals $-3 < x < -2$ and $2 < x < 3$.
A1 for y-intercept AND local minimum in approximately correct positions. Allow for y-intercept $-4.5 < y < -3.5$, and for local minimum $0.2 < x < 1.2$, $-5 < y < -4$.
A1 for approximately correct endpoints, with the left end in the intervals $-4.5 < x < -3.5,\ 2.5 < y < 3.5$ and the right end in the intervals $2.5 < x < 3.5,\ 8.5 < y < 9.5$
[3 marks]

(b)

The graph of g is obtained from the graph of f by a horizontal stretch with scale factor k , followed by a vertical translation of c units.

Find the value of k and the value of c.

[2]

Markscheme
$k = \frac{1}{3}$ ***A1*** $c = -2$ (accept translate/shift 2 (units) down) ***A1*** ***[2 marks]***

45. 23M.2.SL.TZ1.2

(a)

Write down the annual rate of depreciation of the car.

[1]

Markscheme
9% (accept 0.09) ***A1*** ***[1 mark]***

(b)

Find the value of the car on 1 January 2028.

[2]

Markscheme
$t = 5$ (seen anywhere) ***(A1)*** $24961.28 \ldots 25000$ (dollars) ***A1*** ***[2 marks]***

(c)

Find the value of M.

[3]

Markscheme

EITHER $n = 5$ I% $= 3$ $PV = (\pm)15000$ $P/Y = 1$ $C/Y = 1$ ***(A1)*** **Note:** Award ***(A1)*** for use of a financial app in their technology with all entries correct. $(\Rightarrow FV = (\pm)17389.11 \ldots)$

OR $15\,000\left(1+\frac{3}{100}\right)^5$ $(= 17389.11)$ ***(A1)***

THEN subtracting their value from their answer to part (b) ***(M1)*** $7572.17 \ldots 7570$ (dollars) ***A1*** ***[3 marks]***

46. 23M.2.SL.TZ1.5

[5]

Markscheme

METHOD 1 $Q_1 = 31.86$ OR $Q_3 = 32.14$ ***(A1)*** recognition that the area under the normal curve below Q_1 or above Q_3 is 0.25 OR the area between Q_1 and Q_3 is 0.5 (seen anywhere including on a diagram) ***(M1)*** **EITHER** equating an appropriate correct normal CDF function to its correct probability (0.25 or 0.5 or 0.75) ***(A2)*** **OR** $z = -0.674489\ldots$ OR $z = 0.674489\ldots$ (seen anywhere) ***(A1)*** $-0.674489\ldots = \frac{31.86-32}{\sigma}$ OR $0.674489\ldots = \frac{32.14-32}{\sigma}$ ***(A1)*** **THEN** $0.207564\ldots$ $\sigma = 0.208\,(mm)$ ***A1*** **METHOD 2** recognition that the area under the normal curve below Q_1 or above Q_3 is 0.25 OR the area between Q_1 and Q_3 is 0.5 (seen anywhere including on a diagram) ***(M1)*** $z = -0.674489\ldots$ OR $z = 0.674489\ldots$ ***(A1)*** $(Q_1 =)32 - 0.674489\ldots\sigma$ OR $(Q_3 =)32 + 0.674489\ldots\sigma$ ***(A1)*** $(Q_3 - Q1 =)2 \times 0.674489\ldots\sigma$ $2 \times 0.674489\ldots\sigma = 0.28$ ***(A1)*** $0.207564\ldots$ $\sigma = 0.208\,(mm)$ ***A1*** ***[5 marks]***

47. 22N.2.SL.TZ0.3

(a)

Find the coordinates of A.

[2]

Markscheme

$(0.708519\ldots, 0.639580\ldots)$
$(0.709,\ 0.640)$ $(x = 0.709,\ y = 0.640)$ ***A1A1***

[2 marks]

(b)

Find the x-coordinate of B.

[1]

Markscheme

$1.09885\ldots$
$x = 1.10$ accept $(1.10,0)$ ***A1***

[1 mark]

(c)

Find the total area enclosed by the graph of f, the x-axis and the line $x = 2$.

[3]

Markscheme

METHOD 1

$\int_0^2 |f(x)|\,dx$ ***(A1)***

$4.61117\ldots$
area $= 4.61$ ***A2***

METHOD 2

$-\int_{1.09885\ldots}^{2} f(x)dx$ OR $\int_{1.09885\ldots}^{2} |f(x)|\,dx$ OR $4.17527\ldots$ ***(A1)***
$\int_0^{1.09885\ldots} f(x)dx - \int_{1.09885\ldots}^{2} f(x)dx$ OR $0.435901\ldots +$
$4.17527\ldots$ ***(A1)***
$4.61117\ldots$
area $= 4.61$ ***A1***

[3 marks]