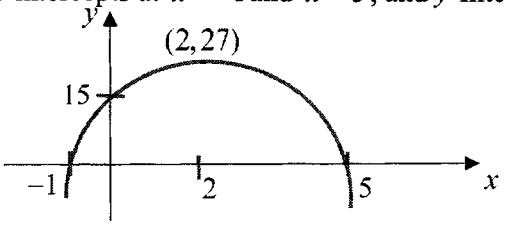
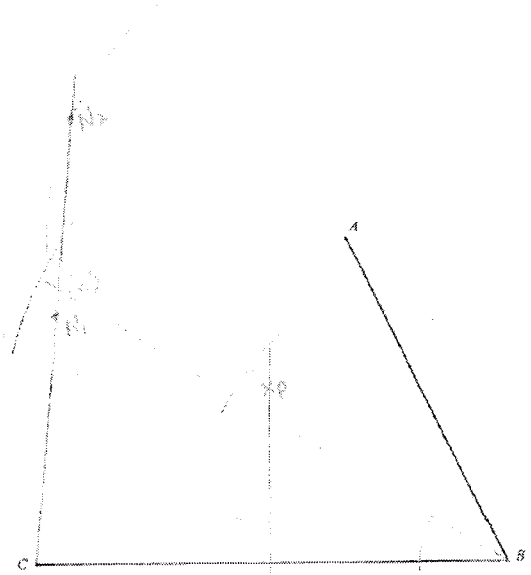
# P1 - Ans

| | | |
|---|---|---|
| 1(a) | $\frac{33.17\times 55.2^{\frac{1}{3}}}{-(-1)+\sqrt[3]{647.9}}$<br>$=13.08359745$<br>$=10$ | B1 |
| 1(b) | $\frac{3m}{s}=\frac{0.003km}{\frac{1}{3600}h}$<br>$=10.8km/h$ | B1 |
| 2(a) | $10^{2m-n}=(10^m)^2\div 10^n$<br>$=2^2\div 11$<br>$=\frac{4}{11}$ | B1 |
| 2(b) | $\frac{7mn^{-1}}{m^2}\div\frac{(mn^2)^3}{7}$<br>$=\frac{7m}{m^2n}\div\frac{m^3n^6}{7}$<br>$=\frac{7m}{m^2n}\times\frac{7}{m^3n^6}$<br>$=\frac{49}{m^4n^7}$ | M1 for either simplying or change of sign<br>A1 |
| 3 | $T=k\sqrt{L}$<br>$1.25T=k\sqrt{L_{New}}$<br>$1.25k\sqrt{L}=k\sqrt{L_{New}}$<br>$1.25\sqrt{L}=\sqrt{L_{New}}$<br>$(1.25)^2L=L_{New}$<br>$\%change$<br>$=\frac{L_{New}-L}{L}\times 100\%$<br>$\frac{(1.25)^2L-L}{L}\times 100\%$<br>$=0.5625\times 100\%$<br>$=56.25\%$ | M1<br>×100% A1 |

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| | | |
|---|---|---|
| 4(a) | 37 min | B1 |
| 4(b) | 25% of 28 = $\frac{25}{100} \times 28$<br>= 7<br>From the stem and leaf diagram, 7 workers took less than 19 minutes to assemble a toy.<br>$p = 19$ min. | A1 |
| 5 | $P = \$12000, R = \frac{7}{2} = 3.5\%$ , $n = 4$<br>$A = P\left(1 + \frac{R}{100}\right)^n$<br>$A = 12000\left(1 + \frac{3.5}{100}\right)^4$<br>$= 13770.27601$<br>$= \$13770.28$<br><br>Compound interest<br>$= 13770.27601 - \$12000$<br>$= \$1770.27601$<br>$= \$1770.28(2d.p)$ | M2,1,0<br><br>A1 |
| 6 | $z = \frac{\sqrt{x^2 + y}}{2}$<br>$2z = \sqrt{x^2 + y}$<br>$4z^2 = x^2 + y$<br>$x^2 = 4z^2 - y$<br>$x = \pm\sqrt{4z^2 - y}$ | M1<br><br>A1 (minus 1 m if no ± ) |
| 7(a)(i) | $x^2 - 6x - 16$<br>$= (x-3)^2 - 16 - (-3)^2$<br>$= (x-3)^2 - 16 - 9$<br>$= (x-3)^2 - 25$ | B2 |
| 7(a)(ii) | $(3, -25)$ | B1 |

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| | | |
|---|---|---|
| 7(a)(iii) | $x = 3$ | B1 |
| 7(b) | B1 – Shape + turning point (2,27)<br>B1 – $x$-intercepts at $x = -1$ and $x = 5$, and $y$-Intercept at (0,15)<br> | |
| 8 | 8 Three points $A$, $B$ and $C$ are shown below.<br><br>(a) Construct the perpendicular bisector of $BC$.<br>(b) Construct the bisector of angle $ABC$.<br>(c) Mark clearly a possible point which is equidistant from $B$ and $C$, and is nearer to $AB$ tha to $BC$. Label this point $P$.<br>(d) The point $N$ is such that angle $BCN = 85°$ and $AN = 7$ cm.<br>Find the two possible positions of $N$ and label them $N_1$ and $N_2$. | |
| 9(a) | $sum = n(3n-2)$<br>1st term<br>$= 1[3(1)-2] = 1$ | |

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| | | |
|---|---|---|
| | Sum of 2 terms<br>$=2[3(2)-2]=8$<br><br>2nd term<br>$=8-1=7$<br><br>Sum of 3 terms<br>$=3[3(3)-2]=21$<br><br>3rd term<br>$=21-8=13$<br><br>First 3 terms: 1, 7, 13 | B2,1,0 |
| 9(b) | $6n-5$ | B1 |
| 10(a) | $(5-2)\times180°=90°+90°+3y$<br>$540°=180°+3y$<br>$3y=360°$<br>$y=120°$<br>$x=360°-120°=240°$<br>$\frac{y}{x}=\frac{120°}{240°}=\frac{1}{2}$ | M1<br><br><br><br><br>A1 |
| 10(b) | $(12-2)\times180°=1800°$<br>$\frac{1800°}{12}=150°$<br>$360°-150°-90°=120°$<br>$180°-120°=60°$<br>$\frac{360°}{60°}=6 sides$ | <br>M1<br><br><br><br>A1 |
| 11 | 1. The title is biased<br>• It does not allow reader to make his/her own judgement<br><u>OR</u><br>2. Horizontal axis does not start from zero<br>• This exaggerates the differences between the data | B1 – Misleading Feature AND – Effect of the misleading feature on interpretation of data |

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|---|---|---|
| 12(a) | $\overrightarrow{CD} = \overrightarrow{OD} - \overrightarrow{OC}$<br>$= \begin{pmatrix} 3 \\ -1 \end{pmatrix} - \begin{pmatrix} -2 \\ 5 \end{pmatrix}$<br>$= \begin{pmatrix} 5 \\ -6 \end{pmatrix}$ | <br><br><br>B1 |
| 12(b) | $\overrightarrow{CE} = n\overrightarrow{CD}$<br>$= n\begin{pmatrix} 5 \\ -6 \end{pmatrix}$<br><br>$\left\|\overrightarrow{CE}\right\| = n\left\|\overrightarrow{CD}\right\|$<br>$= n \times \sqrt{5^2 + (-6)^2}$<br>$= n \times \sqrt{61} = 2\sqrt{61}(given)$<br><br>Since $x$-coordinate of $C$ is greater than the $x$-coordinate of $E$,<br>$\left\|\overrightarrow{CE}\right\| = n \times \sqrt{61} = -2 \times \sqrt{61}$<br><br>$n = -2$<br><br>$\overrightarrow{CE} = \begin{pmatrix} -10 \\ 12 \end{pmatrix}$ | <br><br><br><br>M1<br>$n \times \sqrt{61} = 2\sqrt{61}(seen)$<br><br><br><br><br>A1 |
| 13(a) | $(-6, 5)$, and $(-3, -2)$<br>*Gradient*<br>$= \dfrac{5-(-2)}{-6-(-3)}$<br>$= \dfrac{7}{-3}$<br><br>$y = \dfrac{7}{-3}x + c$<br>Sub $(-6, 5)$<br>$5 = \dfrac{7}{-3}(-6) + c$<br>$c = -9$<br>$y = \dfrac{7}{-3}x - 9$ | <br><br><br><br>M1<br><br><br><br><br>A1 |

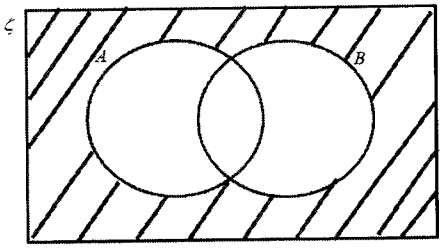
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| | | |
|---|---|---|
| 13(b) | $y=\frac{7}{-3}x+c$<br>Sub (9, 5)<br>$5=\frac{7}{-3}(9)+c$<br>$c=26$<br>$y=\frac{7}{-3}x+26$ | M1<br><br><br><br>A1 |
| 13(c) | $9-(-6)=15$<br>$5-(-2)=7$<br>$Area=\frac{1}{2}\times 15\times 7=52.5$ | M1<br><br>A1 |
| 13(d) | (9, 5) (−3, −2)<br>$BC=\sqrt{(9-(-3))^2+(5-(-2))^2}$<br>$BC=\sqrt{144+49}=\sqrt{193}$<br><br>$Area=\frac{1}{2}\times d\times\sqrt{193}=52.5$<br>$d=\frac{52.5}{\frac{1}{2}\times\sqrt{193}}$<br>$=7.558065$<br>$=7.56(3sf)$ | <br>M1<br><br><br><br><br>A1 |
| 13(e) | $y=\frac{7}{-3}x-9$<br>Sub $y=0$<br>$\frac{7}{3}x=-9$<br>$x=\frac{-27}{7}$<br>$P(\frac{-27}{7},0)$ | <br>M1<br><br><br><br>A1 |
| 14(a) | $AC=\sqrt{12^2+5^2}=13$<br><br>$\cos\angle ACD$<br>$=-\cos\angle ACB$<br>$=-\frac{5}{13}$ | M1<br><br><br><br>A1 |

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| | | |
|---|---|---|
| 14(b) | Using angles in a semicircle, AC is diameter.<br>Radius = $= \frac{13}{2} = 6.5$ | <br><br>B1 |
| 15(a) | 500 | A1 |
| 15(b) | $\frac{500(4)^2 - 500}{500} \times 100\%$<br>$= 1500\%$ | M1<br><br>A1 |
| 15(c) | t=3.5 | A1 |
| 16(a) | $\frac{x^2 + xy}{x^2 + 2xy + y^2}$<br>$= \frac{x(x+y)}{(x+y)^2}$<br>$= \frac{x}{(x+y)}$ | <br><br>M1<br><br>A1 |
| 16 (b) | $10yz - 5y^2 - 2xz + xy$<br>$= 5y(2z - y) - x(2z - y)$<br>$= (5y - x)(2z - y)$ | <br>M1<br>A1 |
| 17(a) | $\frac{3}{5}, \frac{4}{9}$ | B1,0 |
| 17(b) (i) | $\frac{3}{5} \times \frac{4}{9} + \frac{2}{5} \times \frac{2}{3}$<br>$= \frac{8}{15}$ | M1<br><br>A1 |
| 17(b) (ii) | $1 - \frac{3}{5} \times \frac{5}{9}$<br>$= \frac{2}{3}$ | M1<br><br>A1 |
| 18(a) | Deposit $= \frac{20}{100} \times \$1200 = \$240$<br>Remaining amount $= \$1200 - \$240 = \$960$<br>Monthly payment $= \frac{1.5}{100} \times \$960 \times 12$<br>$= \$172.80$<br><br>Total amount paid<br>$= \$172.80 + \$1200$<br>$= \$1372.80$ | <br><br>M1<br><br><br><br>A1 |

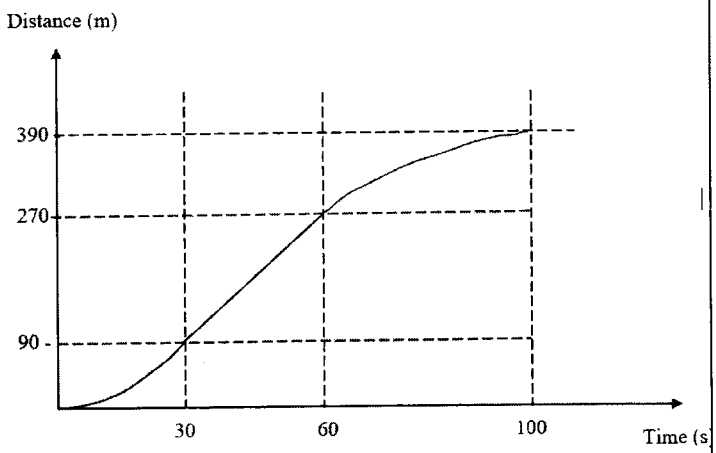
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| | | |
|---|---|---|
| 18(b)(i) | 3 | B1 |
| 18b)(ii) |  | B1 |
| 19(a) | 1 cm : 10 km<br>1 cm² : 100 km²<br>Area (map) = $\frac{225}{100}$<br>= 2.25 cm² | M1<br><br>A1 |
| 19b) | 36 cm² : 225 km²<br>6 cm : 15 km<br>1 cm : 2.5 km<br>1 cm : 250000 cm<br><br>Map scale is 1:250000 | M1<br><br><br>A1 |
| 20(a)(i) | $4624 = 2^4 \times 17^2$ | B1 |
| 20(a)(ii) | $4624 \times \frac{p}{q} = 2^4 \times 17^2 \times \frac{p}{q}$<br>$p = 17, q = 2$ | B1 |
| 20(b) | $a = 27, b = 29, c = 32$ | B2 |
| 21(a) | $\angle AED = \angle BEC$ (vert. opp. ∠s)<br>$\angle EAD = \angle EBC = 24°$ (∠s in the same segment)<br>$\angle EDA = \angle ECB = 67°$ (∠s in the same segment)<br>$\Delta AED$ is similar to $\Delta BEC$ (AA similarity test) | M1 (1 pair of correct corresponding angles with reasons)<br>A1 |
| 21(b) | $\frac{2}{4} = \frac{3.5}{EB}$<br>$EB = 7$<br><br>Alternative solution | M1<br><br>A1<br><br><br>M1 |

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|---|---|---|
| | $\frac{4}{\sin 24°} = \frac{EB}{\sin 67°}$<br>$EB = \frac{4\sin 67°}{\sin 24°} = 9.05cm(3s.f)$ | A1 |
| 21(c) | $\angle AOD = 180° - 67° - 67° = 46°$<br>$\angle BOC = 180° - 24° - 24° = 132°$<br>$\frac{\frac{46}{360} \times 2\pi r}{\frac{132}{360} \times 2\pi r}$<br>$= \frac{46}{132}$<br>$= \frac{23}{66}$ | M1<br><br><br><br>A1 |
| 22(a) | $\frac{\text{Base area of Vase } B}{\text{Base area of Vase } A} = \left(\frac{\text{Base radius of Vase } B}{\text{Base radius of Vase } A}\right)^2$<br>$\frac{\text{Base area of Vase } B}{50} = \left(\frac{3}{1}\right)^2$<br>Base area of Vase $B = \frac{9}{1} \times 50 = 450\ cm^2$ | M1<br><br>A1 |
| 22(b)(i) | $\frac{\text{Curved surface area of Vase } C}{\text{Curved surface area of Vase } A}$<br>$= \frac{\text{Base area of Vase } C}{\text{Base area of Vase } A}$<br>$= \frac{800}{50} = \frac{16}{1}$<br>The required ratio is 16: 1 | <br><br><br>A1 |
| 22(b)(ii) | $\frac{\text{Base area of Vase } C}{\text{Base area of Vase } A} = \frac{16}{1}$<br>$\frac{\text{height of Vase } C}{\text{height of Vase } A} = \frac{\sqrt{16}}{\sqrt{1}} = \frac{4}{1}$<br>$\frac{\text{Volume of Vase } C}{\text{Volume of Vase } A} = \left(\frac{4}{1}\right)^3$<br>$\frac{\text{Volume of Vase } C}{400} = \frac{64}{1}$<br>Volume of Vase $C = \frac{64}{1} \times 400 = 25600\ cm^3$ | <br><br>M1<br><br>A1 |

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|---|---|---|
| 23 (a) | $gradient(acceleration) = \frac{speed}{time}$<br>$= \frac{6-0}{60-100} = -0.15$<br><br>$\frac{v-0}{70-100} = -0.15$<br>$\frac{v}{-30} = -0.15$<br>$v = 4.5\ m/s$ | M1<br><br>A1 |
| 23 (b) | <br>B1 – correct values for distance and time (must be proportionate)<br>B1 – correct shape | |
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**Solutions**

| | | |
|---|---|---|
| **1(a)** | $-\frac{2x+1}{3} \le \frac{3x-1}{-5}$<br>$-\frac{2x+1}{3} \le -\frac{3x-1}{5}$<br>$5(2x+1) \ge 3(3x-1)$<br>$10x+5 \ge 9x-3$<br>$x \ge -8$ | **M1**<br>**A1** |
| **1(b)** | $-\frac{x}{1-3x}+\frac{7}{(3x-1)^2}$<br>$=\frac{x}{3x-1}+\frac{7}{(3x-1)^2}$<br>$=\frac{x(3x-1)}{(3x-1)^2}+\frac{7}{(3x-1)^2}$<br>$=\frac{x(3x-1)+7}{(3x-1)^2}$<br>$=\frac{3x^2-x+7}{(3x-1)^2}$<br><br>**Alt method**<br>$-\frac{x}{1-3x}+\frac{7}{(3x-1)^2}$<br>$=-\frac{x}{1-3x}+\frac{7}{(1-3x)^2}$<br>$=\frac{7}{(1-3x)^2}-\frac{x(1-3x)}{(1-3x)^2}$<br>$=\frac{7-x+3x^2}{(3x-1)^2}$<br>$=\frac{3x^2-x+7}{(3x-1)^2}$ | **M1**<br>**M1**<br>**A1**<br><br>**M1**<br>**M1**<br>**A1** |



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| **1(c)** | $5x = 49 - 4y$ ---------(1)<br>$4x - 5y = -10$ ---------(2)<br>From (1) : $5x + 4y = 49$ ------(3)<br>$(3) \times 4 : 5x + 4y = 49$ ---------(4)<br>$(2) \times 5 : 20x - 25y = -50$ ------(5)<br>$(4) - (5)$ :<br>$16 - (-25y) = 196 - (-50)$<br>$41y = 246$<br>$y = 6$<br>Subt $y = 6$ into (1)<br>$5x = 49 - 4(6)$<br>$5x = 25$<br>$x = 5$<br>**Ans $x = 5$, $y = 6$** | **M1**<br>**A1**<br>**A1** |
| **1(d)** | $\left(\frac{h^{15}}{64f^{12}}\right)^{-\frac{2}{3}} = \left(\frac{64f^{12}}{h^{15}}\right)^{\frac{2}{3}}$<br>$= \left(\frac{64f^{12}}{h^{15}}\right)^{\frac{2}{3}}$<br>$= \frac{16f^8}{h^{10}}$ | **M1**<br>**A1** |
| **2(a)** | $\begin{pmatrix} 164 & 144 & 50 \\ 128 & 90 & 40 \end{pmatrix}$ | **B1** |
| **2(b)** | $\begin{pmatrix} 30 \\ 25 \\ 20 \end{pmatrix}$ | **B1** |
| **2(c)** | $\mathbf{AP} = \begin{pmatrix} 164 & 144 & 50 \\ 128 & 90 & 40 \end{pmatrix}\begin{pmatrix} 30 \\ 25 \\ 20 \end{pmatrix}$<br>$= \begin{pmatrix} 9520 \\ 6890 \end{pmatrix}$<br>$(1\ 1)\mathbf{AP} = (1\ \ 1)\begin{pmatrix} 9520 \\ 6890 \end{pmatrix}$<br>$= (16\ 410)$ | **M1**<br>**A1** |



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| | The element 16410 represents the total amount collected from the sales of tickets for Saturday and Sunday for the 1st weekend. | **B1** |
| **2(d)(i)** | $\begin{pmatrix} 1.25 & 0 & 0 \\ 0 & 1.5 & 0 \\ 0 & 0 & 0.8 \end{pmatrix}$ | **B1** |
| **2(d)(ii)** | Each element in matrix **FP** represents **the total amount collected from the sales of tickets for Saturday and Sunday respectively** for the 2nd weekend. | **B1** |
| **3(a)** | By sine rule,<br>$\frac{BD}{\sin 85°} = \frac{9}{\sin 30°}$<br><br>$BD = 17.9315$ (6s.f)<br><br>$BD = 17.9$ m (3 s.f) | **M1**<br><br>**A1** |
| **3(b)** | $\cos \angle BDA = \frac{6^2 + 17.9315^2 - 14.5^2}{2(6)(17.9315)}$<br><br>$= 46.8039°$ (4 d.p)<br><br>Bearing = $180° + 46.8039°$<br>$= 226.804°$<br>$= 226.8°$ | **M1**<br><br>**M1**<br><br>**A1** |
| **3(c)** | Note : Greatest angle of elevation/depression occurs at shortest distance $CX$.<br><br>In triangle DCX,<br><br>$\sin 65° = \frac{CX}{9}$<br>$CX = 9 \sin 65°$<br><br>Let $\theta$ be the greatest angle of elevation<br>$\tan \theta = \frac{12}{9 \sin 65°}$<br>$\theta = 55.7948°$ (4 d.p)<br>$\theta = 55.8°$ (1 d.p)<br><br>Students may use area of triangle to find $CX$. | **M1**<br><br>**M1**<br><br>**A1** |
| **4(a)** | Vol. of container = $\pi(1.5)^2(10) + \frac{1}{2}\pi(1.5)^2(2)$<br><br>$= 75.3982$ cm$^3$ (4 s.f)<br>$= 75.4$ cm$^3$ (3 s.f) | **M1, M1 for each working**<br><br>**A1** |



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| **4(b)** | Vol. of water $= \frac{75}{100} \times 75.3982$<br>$= 56.5487$ (4 s.f)<br><br>Height of water $= \frac{56.5487}{\pi(1.5)^2}$<br>$= 8.00$ cm<br><br>$d = 10 + 2 - 8.0000$<br>$= 4.00$ (3 s.f) | **M1**<br><br>**M1**<br><br>**A1** |
| **4(c)** | Let the height of pyramid be $h$ cm.<br>$\frac{1}{3} \times 4 \times 4 \times h = 56.5487$<br>$h = 10.6029$ (6 s.f)<br>$h = 10.6$ cm (3 s.f) | **M1**<br><br>**A1** |
| **4(d)** | Time $= \left[1 - \left(\frac{2}{3}\right)^3\right] x$<br>$= \frac{19}{27} x$ minutes<br><br>Accept $\frac{1}{27} x$ minutes (as students may see it in another perspective) | **B1** |
| **5(a)** | $P = -0.05$ | **B1** |
| **5(b)** | Refer to graph paper | |
| **5(c)** | The graph $y = \frac{x^2}{7} + \frac{2}{x} - 2$ **cuts the $x$-axis at 2 points.** Hence,<br>$\frac{x^2}{7} + \frac{2}{x} - 2 = 0$ has 2 solutions | **B1** |
| **5(d)** | Accurate tangent line drawn<br><br>Gradient $= \frac{1.8}{1.8}$<br>$= 1$ (accepts $1.02 \pm 0.05$) | **M1**<br><br>**A1** |
| **5(e)** | $x^3 + 7x^2 - 28x + 14 = 0$<br>$x^2 + 7x - 28 + \frac{14}{x} = 0$<br>$\frac{x^2}{7} + x - 4 + \frac{2}{x} = 0$<br>$\frac{x^2}{7} + \frac{2}{x} - 2 = -x + 2$<br><br>Line $y = 2 - x$ drawn<br><br>From graph,<br>$\underline{x = 2.35} \pm 0.05$ | **M1**<br><br>**M1**<br><br>**A1** |



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| **6(a)(i)** | $\angle OBI = 90°$ (tan perpendicular rad)<br>$\angle OCI = 90°$ (tan perpendicular rad)<br>$OI$ is a common line.<br>$OB = OC$ (radii of the same circle)<br><br>By **RHS,** triangle $OBI$ is congruent to triangle $OCI$. | **M1**<br><br>**A1** |
| **6(a)(ii)(a)** | $\angle DCB = 180 - (62 + 70)$ ($\angle$ in opposite segment)<br>$= 48°$ | **B1** |
| **6(a)(ii)(b)** | $\angle GCE = \angle GAB$<br>$= 62°$ ($\angle$ in the same segment)<br>$OC = OE$ (radii of the same circle)<br>$\angle OCE = \angle OEC = 76°$ (base of isos triangle)<br>$\angle GOC = 76 - 62$<br>$= 14°$<br><br>Accepts other methods ( eg. Find angle $OBC$ first) | **M1**<br><br>**A1** |
| **6(a)(ii)(c)** | $\angle OCH = 90°$(tan perpendicular rad)<br>$\angle BCH = 90 + 14$<br>$= 104°$ | **B1** |
| **(b)** | Major arclength $= (2\pi - 2.18) \times 8$<br>$= 16\pi - 17.44$<br><br>$AD^2 = 8^2 + (8+3.6)^2 - 2(8)(8+3.6)\cos 2.18$<br>$AD = 17.4575$ (6s.f)<br><br>Perimeter $= 16\pi - 17.44 + 3.6 + 17.4575$<br>$= 53.9$ cm (3 s.f) | **M1**<br><br>**M1**<br><br>**M1**<br>**A1** |
| **(c)** | $\dfrac{\text{area of sector ABCO}}{\text{area of triangle AOD}} = \dfrac{\frac{1}{2} \times (8)^2 \times (2\pi - 2.18)}{\frac{1}{2} \times (8) \times (8+3.6) \sin 2.18}$<br>$= 3.45052$ (5 d.p)<br>$= 3.45$ (2 d.p) | **M1 for denominator**<br>**M1 for numberator**<br><br>**A1** |
| **7(a)** | Mean $= \dfrac{22(8) + 26(10) + 30(21) + 34(7) + 38(4)}{50}$<br>$= 29.12$ minutes<br><br>$\dfrac{\sum fx^2}{N} = \dfrac{8(22)^2 + 10(26)^2 + 21(30)^2 + 7(34)^2 + 4(38)^2}{50}$<br>$= 868$<br><br>Standard deviation $= \sqrt{868 - 29.12^2}$<br>$= 4.474997$ | **M1**<br><br>**M1**<br><br>**A1** |
| **7(b)** | The **mean waiting time for hospital A** and hospital **are the same (29.12 min).** Hence, the average waiting time is generally the same for both hospital. | **B1** |



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|---|---|---|
| | However, the **standard deviation for waiting times in hospital B (3.2 min) is lower than the waiting times in hospital A (4.47 min)**. Hence, the waiting times in hospital B are more consistent. | **B1** |
| **7(c)** | P(required) $= \frac{8}{50}\times\frac{11}{49}+\frac{11}{50}\times\frac{8}{49}$<br>$= \frac{88}{1225}$<br>Accepts other relevant method | **M1**<br>**A1** |
| **8(a)(i)** | $-\underset{\sim}{a}+\underset{\sim}{b}$ | **B1** |
| **8(a)(ii)** | $\overrightarrow{CD} = \overrightarrow{CO}+\overrightarrow{OD}$<br>$= \frac{2}{3}(-\underset{\sim}{a})+\frac{1}{2}(\underset{\sim}{b})$<br>$= -\frac{2}{3}\underset{\sim}{a}+\frac{1}{2}\underset{\sim}{b}$<br>$\overrightarrow{CE} = \frac{1}{2}\left(-\frac{2}{3}\underset{\sim}{a}+\frac{1}{2}\underset{\sim}{b}\right)$<br>$= -\frac{1}{3}\underset{\sim}{a}+\frac{1}{4}\underset{\sim}{b}$ | **M1**<br>**A1** |
| **8(b)(i)** | $\overrightarrow{OF} = \overrightarrow{OA}+\overrightarrow{AF}$<br>$= \underset{\sim}{a}+m(-\underset{\sim}{a}+\underset{\sim}{b})$<br>$= (1-m)\underset{\sim}{a}+m\underset{\sim}{b}$ | **M1**<br>**A1** |
| **8(b)(ii)** | $\overrightarrow{OE} = \frac{3}{5}\overrightarrow{OF}$<br>Since $\overrightarrow{OE}$ is a scalar multiple of $\overrightarrow{OF}$ and there is a common point $O$, $O$, $E$ and $F$ lie on a straight line. | **M1**<br>**A1** |
| **8(c)(i)** | $\frac{\text{area of triangle AEC}}{\text{area of triangle OEC}} = \frac{\frac{1}{2}\times 1\times h}{\frac{1}{2}\times 2\times h}$<br>$= \frac{1}{2}$ | **B1** |
| **8(c)(ii)** | $\frac{\text{area of triangle OCD}}{\text{area of triangle OAD}} = \frac{\text{area of triangle OCD}}{\text{area of triangle OAD}}\times\frac{\text{area of triangle OAD}}{\text{area of triangle OAB}}$<br>$= \frac{2}{3}\times\frac{1}{2}$<br>$= \frac{1}{3}$<br>**Accepts other methods** | **B1** |
| **9(a)** | Time taken by Ali $= \frac{42}{x}$ h<br>Time taken by Robert $= \frac{42}{x-2}$ h | |



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|---|---|---|
| | $\frac{42}{x-2}-\frac{42}{x}=\frac{1}{2}$ | M1 ($\frac{42}{x}$ and $\frac{42}{x-2}$ seen) |
| | $\frac{42x-42(x-2)}{x(x-2)}=\frac{1}{2}$ | M1 |
| | $\frac{84}{x(x-2)}=\frac{1}{2}$<br>$x(x-2)=168$ | M1 |
| | $x^2-2x-168=0$ | M1 (able to reduce) |
| **9(b)** | $x^2-2x-168=0$<br>$(x+12)(x-14)=0$<br>$x=-12$ *or* $x=14$<br>Accept by Formula method | M1<br>A1 |
| **9(c)** | Since $x$ represents speed, $x$ cannot be negative. | B1 |
| **9(d)** | Time taken = $\frac{42}{14-2}$<br>$=3.5\,\text{h}$ | B1 |
| **10(a)** | Total time taken = 13 h 50 min + 2 h<br>= 15h 50 min<br>Time = 8.05 am | B1 |
| **10(b)** | Total per day = £25 + £10 + £15<br>= £50<br>Total for 6 days = $6\times50$<br>= £300 | M1 |
| | Assuming that he needs to save 10% of the total amount of $700<br>Total planned spending = $300(1.65)+\frac{10}{100}\times700$<br>= $565 | M1 |
| | **Sufficient** | A1 |
| | Alternative Solutions :<br>Assuming that he needs to save 10% of the total amount planned for 6 days :<br>Total planned spending = $300(1.65)+\frac{10}{100}\times(300\times1.65)$<br>= $544.50 | M1* |



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| | | |
|---|---|---|
| **10(c)** | Budget = $15 \times 4$<br>=£60<br><br>**Option A**<br>Full price = £60<br>Discount = $\frac{5}{100} \times 90$<br>= £4.50<br><br>Final cost = 60 - 4.50<br>= £55.50<br>Exceed budget<br><br>**Option B**<br>8 attractions ×12.50<br>=£100<br><br>Exceed budget<br><br>**Option C**<br>2 day pass = £35<br>Remaining 2 days = 4 attractions ×6<br>=£24<br>Total cost = £35 + £24<br>=£59<br><br>Cover all attractions with sufficient budget.<br>Money left = £60 – £59<br>= £1<br><br>I would recommend C.<br>It meets all her sightseeing needs at the lowest cost and meeting her budget of \$60. | **M1**<br><br>**M1**<br><br>**M1**<br><br>**M1**<br><br>**A1** |



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