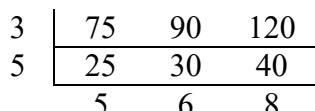


Question	Working	Answer	Mark	Notes
2 (a)	$75 = 3 \times 5 \times 5$ $90 = 2 \times 3 \times 3 \times 5$ $120 = 2 \times 2 \times 2 \times 3 \times 5$ or correct factor trees or 			M1 implied by correct answer
		15	2	A1
(b)	Both could sound together at 9.22 and LCM of 8 and 12 is 24 or 930 938 946 910 922 934 946			M1
		09 46 oe	2	A1
Total 4 marks				

Question	Working	Answer	Mark	Notes
3 (a)	$3a + 5a = 4 - 6$ oe			M1
		$-\frac{1}{4}$	2	A1
(b)	$-3p > 12$ or $-12 > 3p$			M1
		$p < -4$	2	A1
(c)		$w \leq 5$	1	B1 allow use of $x \leq 5$
(d)		$x \geq -1$ or $x > -1$ and $y \geq 0$ or $y > 0$	1	B1 allow $-1 < x < n$ where $n \geq 2$ allow $0 < y < m$ where $m \geq 6$
	$y = -2x + \dots$ or $y = \dots x + 4$			M1
		$y \leq -2x + 4$ or $y < -2x + 4$ oe	2	A1
Total 8 marks				

Question	Working	Answer	Mark	Notes
4 (a)		$x, 23-x, 31-x, 27-x$ $x-5, x-10, x-10$ 0	3	B1 B1 B1
(b)	$x + 56 = 75$			M1ft
		19	2	A1
(c)(i)	17		1	B1ft their "27" - "10"
(ii)	44		1	B1ft $2x - "5" + "31" - "20$
(d)	$\frac{"19" - 5}{49}$			M1 denominator of 49, numerator < 49
		$\frac{14}{49}$	2	A1ft oe (0.2857... allow 2dp truncated or rounded)
Total 9 marks				

Question	Working	Answer	Mark	Notes
5 (a)	Factorising into 2 brackets			M1 When multiplied out it must give at least 2 of the 3 terms correct
		$(x+6)(x-1)$	2	A1
(b)	$\frac{4(x+3)-5(2x-2)}{20}$ or $\frac{x+3}{5} - \frac{x-1}{2}$			M1
	$\frac{4x+12-10x+10}{20}$ or $\frac{2x+6-5x+5}{10}$			M1
		$\frac{-3x+11}{10}$	3	A1oe
Total 5 marks				

Question	Working	Answer	Mark	Notes
6 (a)		Triangle A	1	B1
(b)	$\begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} 1 & 3 & 4 \\ 1 & 1 & 3 \end{pmatrix}$			M1
	$\begin{pmatrix} -2 & -6 & -8 \\ 2 & 2 & 6 \end{pmatrix}$			A1
		Triangle B	3	A1
(c)		Triangle C	1	B1

Question	Working	Answer	Mark	Notes
(d)	$\mathbf{N} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ <p>Or</p> <p>$A \rightarrow C$ is an enlargement with centre O and scale factor -2 so that</p> $\begin{pmatrix} 1 \\ 0 \end{pmatrix} \mapsto \begin{pmatrix} -2 \\ 0 \end{pmatrix} \text{ and } \begin{pmatrix} 0 \\ 1 \end{pmatrix} \mapsto \begin{pmatrix} 0 \\ -2 \end{pmatrix}$			M1 Allow M1 for $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$
		$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	2	A1
(e)	Rotation 180° about any point			M1
		Triangle D	2	A1
(f)		Enlargement	1	B1
		SF $\frac{1}{2}$	1	B1
		centre $(-2, -2)$	1	B1
Total 12 marks				

Question	Working	Answer	Mark	Notes
7 (a)		$5 < t \leq 8$	1	B1
(b)	$2.5 \times 10 + 6.5 \times 8 + 9 \times 5 + 12.5 \times 3 + 22.5 \times 2$ $(= 204.5)$			M2 for at least 4 correct products added OR (M1 for use of a value within interval (incl. end points) for at least 4 products, which must be added).
	$\frac{"204.5"}{28}$			M1(dep) on at least M1
		awrt 7.3	4	A1
(c)		Bar drawn height 30 little squares	1	B1
(d)		$\frac{5}{35}$ oe	1	B1 (0.14(28571...) or 14(.28571)%)
Total 7 marks				

Question	Working	Answer	Mark	Notes
8	5010, 4990, 10100, 9900, 33.5, 34.5, 68.5, 67.5			M1 at least 1 from each row.
	Colin $\frac{10100}{67.5}$ or $\frac{10.1}{67.5}$			A1
	Jenny $\frac{4990}{34.5}$ or $\frac{4.99}{34.5}$			A1
	$\frac{\left(\frac{10100}{67.5} - \frac{4990}{34.5}\right) \times 60}{1000}$			M1
		0.2995 (km/h)	5	A1
Total 5 marks				

Question	Working	Answer	Mark	Notes
9 (a)	$8y^2 - \dots = 400$ or ... $-2x^2 = 400$ or $2y(4y - x) + \dots = 400$ or ... $+ x(2y - x) = 400$			M1
	$4y^2 - x^2 = 200$			A1cso
	$10y + 2x + 5 = 2y$ therefore $2y = 2x + 5$		3	B1cso
(b)	$(2x+5)^2 - x^2 = 200$	$4y^2 - \left(\frac{2y-5}{2}\right) = 200$		M1
	$3x^2 + 20x - 175 = 0$	$12y^2 + 20y - 825 = 0$		M1 Rearranging correctly to get a 3 term quadratic
	$(3x+35)(x-5)=0$ $\underline{-20 \pm \sqrt{20^2 - 4 \times 3 \times -175}}$ 2×3	$(2y-15)(6y+55)=0$ $\underline{-20 \pm \sqrt{20^2 - 4 \times 12 \times -825}}$ 2×12		M1 dep on M1 for solving their quadratic equation using any correct method - if factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{-20 \pm \sqrt{400+2100}}{6}$ or eg $3\left(x+\frac{20}{6}\right)^2 - \frac{625}{3}$)
	$3[(x+\frac{20}{6})^2 - (\frac{20}{6})^2] - 175$	$12[(y+\frac{20}{24})^2 - (\frac{20}{24})^2] - 825$		

	$x = 5$	$y = 7.5$			A1 one correct result for x or for y (ignore negative value for this mark)
	$y = \frac{2 \times "5" + 5}{2}$	$x = \frac{2 \times "7.5" - 5}{2}$			M1
			$x = 5$ and $y = 7.5$	5	A1 dep on M2 (positive values only)
Total 8 marks					

Question	Working	Answer	Mark	Notes
10 (a)	$3 \times \left(\frac{1}{3}\right)^3 - 7 \times \left(\frac{1}{3}\right)^2 + 5 \times \frac{1}{3} - 1$			M1
		$= 0, (3x - 1) \text{ is a factor}$	2	A1
(b)	$x^2 - 2x + 1$			M1
	$(x-1)(x-1)$			M1
		$x = \frac{1}{3} \text{ or } 1$	3	A1
(c)	$\frac{dy}{dx} = 9x^2 - 14x + 5$			M1
	$(x-1)(9x-5) = 0$			M1
		$1, \frac{5}{9}$		A1
	Substituting x values into $y = 3x^3 - 7x^2 + 5x - 1$			M1
		$(1, 0)$ $\left(\frac{5}{9}, \frac{32}{243}\right)$	5	A1
(d) (i)		5	1	B1ft (ft $\frac{dy}{dx}$)
(ii)	$y = "5"x - 1$			M1
		$y = 5x - 1$	2	A1oe
Total 13 marks				

Question	Working	Answer	Mark	Notes
11 (a)	SF $\frac{1}{5}$			B1 use or statement of the correct SF
	$\frac{1}{3}(\pi) \times 30^2 \times 100 - \frac{1}{3}(\pi) \times "6"^2 \times 20 \text{ oe}$			M1
		29760	3	A1
(b)		40800π	1	B1
(c)	$\frac{2}{3}\pi \times 30^3 + \dots$			M1
	$g = \text{height of small cone}$ $\frac{2}{3}\pi \times 30^3 +$ $\frac{1}{3}\pi \times 30^2 \times 108 - \frac{1}{3}\pi \times \left(\frac{30}{108}g\right)^2 \times g = "40800\pi"$ $0.02572g^3 = 9600$		M1 Condone $30k^2$ A1 Correct equation	
	$g = 72$			A1
	$h = 30 + (108 - 72)$			M1
		awrt 66	6	A1
Alternate method				
	$V_{\text{hemisphere}} = \frac{2}{3}\pi \times 30^3 [= 18000\pi]$			M1
	$V_{\text{frustum}} = 40800\pi - 18000\pi [= 22800\pi]$			

	$V_{\text{whole cone}} = \frac{1}{3}\pi \times 30^2 \times 108 [= 32400\pi]$			
	$V_{\text{top cone}} 32400\pi - 22800\pi [= 9600\pi]$			M1
	$V_{\text{top cone}} : V_{\text{whole cone}} = 9600\pi : 32400\pi$			A1
	$= 8 : 27$			
	$H_{\text{top cone}} : H_{\text{whole cone}} = 2 : 3$			A1
	$\frac{138-h}{108} = \frac{2}{3}$			M1
		awrt 66		A1
Total 10 marks				

Question	Working	Answer	Mark	Notes
12 (a)	$\frac{1}{2} \mathbf{b} \pm \frac{1}{5} \mathbf{a}$			M1
		$-\frac{1}{5} \mathbf{a} + \frac{1}{2} \mathbf{b}$	2	A1
(b)	$\overrightarrow{FC} = \frac{4}{5} \mathbf{a} + 2 \overrightarrow{AB}$			M1 or $\overrightarrow{EC} = -\frac{1}{2} \mathbf{b} + \mathbf{a} + 2 \overrightarrow{AB}$
	$\overrightarrow{FC} = \frac{4}{5} \mathbf{a} + 2(\mathbf{b} - \mathbf{a})$			M1 or $\overrightarrow{EC} = -\frac{1}{2} \mathbf{b} + \mathbf{a} + 2(\mathbf{b} - \mathbf{a})$
	$\overrightarrow{FC} = 2\mathbf{b} - \frac{6}{5} \mathbf{a}$			A1 or $\overrightarrow{EC} = \frac{3}{2} \mathbf{b} - \mathbf{a}$
	$2\mathbf{b} - \frac{6}{5} \mathbf{a}$ is not a multiple of $\frac{1}{2} \mathbf{b} - \frac{1}{5} \mathbf{a}$ therefore F, E and C are not collinear.		4	A1 $\frac{5}{3} \mathbf{b} - \mathbf{a}$ is not a multiple of $\frac{1}{2} \mathbf{b} - \frac{1}{5} \mathbf{a}$ therefore F, E and C are not collinear.
(c)	$\overrightarrow{OG} = \mathbf{a} + m(\mathbf{b} - \mathbf{a})$			M1
	$\overrightarrow{OG} = \frac{1}{5} \mathbf{a} + n \left(-\frac{1}{5} \mathbf{a} + \frac{1}{2} \mathbf{b} \right)$			M1
	$\left(\frac{1}{5} - \frac{1}{5} n \right) = 1 - m$ or $m = \frac{1}{2} n$			M1
	$n = \frac{8}{3}$ or $m = \frac{4}{3}$			A1