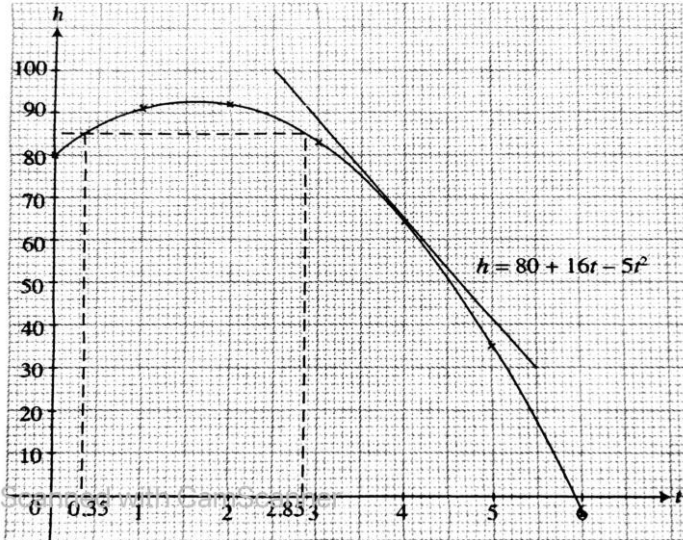


Qn		Steps/Answer	Remarks
1	(a)	$USD = \frac{10000}{x}$	
	(b)	$\frac{10000}{x - 0.030} - \frac{10000}{x} = 166$ $10000x - 10000(x - 0.030) = 166x(x - 0.030)$ $166x^2 - 4.98x - 300 = 0$ $83x^2 - 2.49x - 150 = 0$	
	(c)	$x = \frac{2.49 \pm \sqrt{(-2.49)^2 - 4(83)(-150)}}{2(83)}$ $x = 1.359 \text{ or } x = -1.329$	
	(d)	$\frac{20000}{1.359 - 0.030}$ $= \text{USD } 15\,049$	Accept 15 048
2	(ai)	$s = [5 - 3(-3)^2] \div (-3)^2$ $s = -2\frac{4}{9} \text{ or } s = -\frac{22}{9}$	Cannot accept 3 sf
	(aii)	$sq^2 = r - 3q^2$ $sq^2 + 3q^2 = r$ $q^2(s + 3) = r$ $q = \pm \sqrt{\frac{r}{s + 3}}$	
	(b)(i)	$(7n - 1)^2 - (n - 1)^2$ $= [(7n - 1) + (n - 1)][(7n - 1) - (n - 1)]$ $= 6n(8n - 2)$ $= 12n(4n - 1)$	$= 12(4n^2 - n)$ is also accepted
	(b)(ii)	$\frac{p - 3n + 12n^2 - 4np}{(7n + 1)^2 - (n - 1)^2}$ $= \frac{p(1 - 4n) - 3n(1 - 4n)}{12n(4n - 1)}$ $= \frac{(3n - p)(4n - 1)}{12n(4n - 1)}$ $= \frac{3n - p}{12n}$	

3	(a)	<p><u>One possible answer</u></p> <ul style="list-style-type: none"> • $ET = AT$ (tangents from external points are equal) • TO is common • $OE = OA$ (radii of circle) <p>Triangle TOA is congruent to triangle TOE (SSS test)</p>	
		<p><u>Another possible answer</u></p> <ul style="list-style-type: none"> • angle $TAO = \text{angle } TEO = 90^\circ$ (tangent perpendicular to radius) • TO is common • $OE = OA$ (radii of circle) <p>Triangle TOA is congruent to triangle TOE (RHS test)</p>	
	(bi)	<p>angle $AOT = (180 - 90 - 32)^\circ = 58^\circ$ (tangent perpendicular to radius)</p>	
		<p>angle $ABF = \frac{1}{2}\text{angle } AOT = \frac{1}{2}(58^\circ) = 29^\circ$ (angle at centre is twice angle at circumference)</p>	
		<p>angle $OFG = \text{angle } ABF = 29^\circ$ (alternate angles, $OF \parallel BA$)</p>	
	(bii)	<p>angle $ACF = \text{angle } ABF = 29^\circ$ (angles in the same segment)</p>	
		<p>angle $CAE = 180 - 90 - 29 = 61^\circ$ (OT is perpendicular bisector of chord AE)</p>	
		<p>angle $CDE = 180 - 61 = 119^\circ$ (angles in opposite segments)</p>	
	(c)	<p>As angle OET and angle OAT are right-angles, by the property of right angle in a semicircle, OT is a diameter and points E and A will lie on the circumference. $OETA$ are thus four points on the circumference of this circle.</p> <p><u>Or</u></p> <p>Angle $AOE + \text{angle } ATE = (58 \times 2) + (32 \times 2) = 180^\circ$ Angle $OET + \text{angle } OAT = 180^\circ$.</p> <p>By the property of angles in opposite segments, $OETA$ are thus four points on the circumference of this circle.</p>	
4	(a)(i)	<p>$\overrightarrow{AB} = 2b - a$</p>	
	(a)(ii)	<p>$\overrightarrow{BC} = -\frac{3}{4}\overrightarrow{BA} = -\frac{3}{4}(2b - a)$</p>	
		<p>$\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = 2b - \frac{3}{4}(2b - a) = \frac{3}{4}a + \frac{1}{2}b$</p>	
	(b)(i)	<p>$\overrightarrow{OP} = \overrightarrow{OB} + \overrightarrow{BP} = 2b + 3a$</p>	
	(b)(ii)	<p>$\overrightarrow{OP} = 3a + 2b$. $\overrightarrow{OC} = \frac{1}{4}(3a + 2b)$</p>	
		<p>As $\overrightarrow{OC} = \frac{1}{4}\overrightarrow{OP}$,</p>	
		<p>and O is a common point, O, C and P lie on a straight line.</p>	

	(ci)	3:1	
	(cii)	$OAC : OAB : OAD$ $1 : 4$ $2 : 1$ $4 : 2$ Therefore, $OAC : OAD$ is $1 : 2$.	
5	(a)	$p = -4$	
	(b)		
	(c)	The maximum point of the curve is 93m.	$\pm 1\text{m}$
	(d)	$2.9 - 0.3 = 2.6$	$\pm 0.2\text{s}$
	(e)	Tangent drawn correctly	
		$-24 (\pm 4)$	
		m/s	

6	(a)	volume of water = $\pi(10^2)(80) +$ $(\frac{2}{3})(\pi)(10^3)$		
		$= 8666\frac{2}{3}\pi$		
	(b)	Capacity of one conical cup = $(\frac{1}{3})(\pi)(3^2)(5.3)$ $= 50 \text{ cm}^3$		
			<u>Alternative</u>	
	(c)	Volume of water remaining after dispensing 250 cups $= 8666\frac{2}{3}\pi - (250 \times \frac{1}{3}\pi(3^2)(5.3))$ $= 4691\frac{2}{3}\pi \text{ or } 14739 \text{ cm}^2.$	Volume of water dispensed for 250 cups $= 250 \times 15.9\pi$	
		Volume of water in cylinder = $4691\frac{2}{3}\pi - \frac{2}{3}\pi(10^3)$ $= 4025\pi \text{ or } 12645 \text{ cm}^2.$	Height of water dispensed for 250 cups $= \frac{250 \times 15.9\pi}{100\pi}$	
		Height of water in cylindrical section $= \frac{4025\pi}{\pi(10^2)} \text{ or } \frac{12645}{\pi(10^2)}$ $= 40.25 \text{ or } 40.250$	Height of water remaining in dispenser $= 90 - \frac{125}{\pi}$	
		Height of water remaining in dispenser $= 40.25+10 \text{ or } 40.250+10$ $= 50.25 \text{ cm or } 50.3 \text{ cm}$	$= 50.2 \text{ (3sf)}$	
	(d)	Slant height of cup = $\sqrt{3^2 + 5.3^2}$ $= 6.0902$		
		Curved surface area of cup = $\pi(3)(6.0902)$ $= 57.399 \text{ cm}^2$		
		250 cups will cost $57.399 \times 250 \times$ 0.003 $= 43 \text{ cents}$		Accept 44 cents

7	(a)	$18.5 \times 7500 \div 100000$ 1.3875 km	M1 A1	c.a.o.
	(b)	$6^2 = 7^2 + 5.5^2 - 2(7)(5.5) \cos \angle PQR$	M1	Or equivalent method leading to the correct bearing
		$\cos \angle PQR = \frac{-43.25}{-77}$	M1	
		$\text{angle } PQR = 55.827^\circ$	M1	
		Bearing of Q from R is $(180+55.827) = 235.8^\circ$	A1	
	(c)	Area of $QPR = \frac{1}{2}(7 \times 75)(5.5 \times 75) \sin 55.827^\circ$	$\sqrt{M2}$	
		$= 89\,585 \text{ m}^2$ $= 89\,600 \text{ m}^2$	A1	
	(d)	Let shortest distance from R to PQ be X .		
		$\sin \angle PQR = \frac{RX}{QR}$		
		$\sin 55.827^\circ = \frac{RX}{412.5}$	M1	Or equivalent method
		$RX = 341.28\text{m}$	M1	
		Let greatest angle of elevation be y .		
		$\tan y = \frac{75}{\text{their } RX}$	M1	
		$y = 12.4^\circ$	A1	

8	(ai)	15 marks											
	(aia)	18 – 12											
		6 marks											
	(b)	20.5 marks											
	(c)	<table><tr><td>Marks (x)</td><td>$4 \leq x < 10$</td><td>$10 \leq x < 15$</td><td>$15 \leq x < 20$</td><td>$20 \leq x < 24$</td></tr><tr><td>Number of students</td><td>6</td><td>14</td><td>14</td><td>6</td></tr></table>	Marks (x)	$4 \leq x < 10$	$10 \leq x < 15$	$15 \leq x < 20$	$20 \leq x < 24$	Number of students	6	14	14	6	
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Number of students	6	14	14	6									
	(ci)	$\frac{(6 \times 7) + (14 \times 12.5) + (14 \times 17.5) + (6 \times 22)}{40} = 14.85$											
	(cii)	4.62											
		<u>Alternative answer</u>											
	(c)	<table><tr><td>Marks (x)</td><td>$4 \leq x < 10$</td><td>$10 \leq x < 15$</td><td>$15 \leq x < 20$</td><td>$20 \leq x < 24$</td></tr><tr><td>Number of students</td><td>7</td><td>13</td><td>14</td><td>6</td></tr></table>	Marks (x)	$4 \leq x < 10$	$10 \leq x < 15$	$15 \leq x < 20$	$20 \leq x < 24$	Number of students	7	13	14	6	
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Number of students	7	13	14	6									
	(ci)	$\frac{(6 \times 7) + (14 \times 12.5) + (14 \times 17.5) + (6 \times 22)}{40} = 14.7125$											
	(cii)	4.76											
	(d)	15											
	(e)	<p>The students performed better in Mathematics as the median score (15 marks) was higher than Chemistry's (14 marks)</p> <p>The students performed more consistently in Chemistry as the interquartile range (3 marks) is lower than Mathematics (6 marks)</p>											

9	(a)	$\$4100 \left(1 + \frac{4}{100}\right)^5 = \4988 $= \$5000$	
	(b)	Justification: Choose the highest COE price recorded in the past 12 months to cover the worst-case scenario	
			<u>EV 60kWh</u>
		Cost price of car	$\$(100,000 + 105,000 - 30,000)$ $= \$175,000$
		Minimum downpayment	$40\% \times \$175,000 = \$70,000$
			<u>1998cc petrol car</u>
		Cost price of car	$\$(110,000 + 150,000) = \$260,000$
		Minimum downpayment	$30\% \times \$260,000 = \$78,000$
		6 months of Lee's salary	$= 6 \times \$5000 = \$30,000$
		Savings – downpayment	<u>EV 60kWh:</u> $\$(105,000 - 70,000) = \$35,000$ <u>1998cc petrol car:</u> $\$(105,000 - 78,000) = \$27,000$
		conclusion	Lee can only afford the downpayment for the EV 60kWh. $(\$35,000 - \$30,000 = \$5000)$
	(c)	To determine if Lee can afford the car in Jan 2024.	
		i) <u>Road Tax</u>	$[250 + 3.75(60 - 30)] \times 0.7826 \div 6$ $= \$47.246$
		ii) Loan amount	$175000 - 70000 = \$105,000$
		Interest	$\frac{105,000 \times 2.78 \times 7}{100} = \$20,433$
		(iii) <u>Monthly Instalment</u>	$(105,000 + 20,433) \div 84$ $= \$1493.25$
		iv) <u>Other costs (monthly basis)</u>	$\frac{4700}{12} + 600 = \991.667
		Total monthly expense	$\$2532.1625$
		Spare cash for the month	$5000 - 2700 = \$2300$
		v) Affordability Spare cash – total monthly expenses	$2300 - 2532.1625$ $= -\$232.1625$ Lee <u>would not be</u> able to afford the car.
			However, if we take into consideration that Lee still has \$5,000 remaining after making the downpayment in part (b), with \$30,000 already set aside, he <u>would be</u> able to afford the car