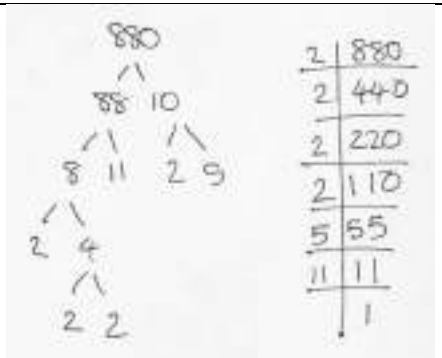
International GCSE Maths				
Apart from questions 2, 6, 15, 18 and 26, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	0.4 × 280 oe		2	M1
		112		A1 cao SC B1 for 168
				Total 2 marks

2			3	M1 for continual prime factorisation (at least two correct steps anywhere) or at least two stages of a factor tree, or table, correct. eg if first stage wrong, 800 × 80 then 800 = 80 × 10 and 80 = 40 × 2 would count as 2 correct steps.
				M1 dep M1 for a fully correct factor tree or a list (2,2,2,2,5,11) condone inclusion of 1's on branch ends. **or** 2 × 2 × 2 × 2 × 5 × 11
		$2^4 \times 5 \times 11$		A1 dep M2 for $2^4 \times 5 \times 11$ (with working seen)
				Total 3 marks

3	(a)		2 460 000	1	B1	accept 2,460,000 or 246 0000
	(b)		7.4×10^{-4}	1	B1	
	(c)			2	M1	for correct value not in standard form e.g. 58.3×10^5 or 583×10^4 or 0.583×10^7 oe
			5 830 000		A1	5 830 000 or 5.83×10^6 do not isw.
						Total 4 marks

4			3	M1	for one of - 5 numbers with a median of 8 - 5 numbers with a mode of 5 - 5 numbers with a range of 10 - 5 numbers with a sum of 45
				M1	for two of - 5 numbers with a median of 8 - 5 numbers with a mode of 5 - 5 numbers with a range of 10 - 5 numbers with a sum of 45
		5, 5, 8, 12, 15		A1	Note: The numbers can be in any order SC If no marks awarded, give B1 for 8 in the middle cell, not contradicted.
					Total 3 marks

5	(a)		33.75	1	B1	oe eg 33.750
	(b)		33.85	1	B1	allow $33.84\dot{9}$ or 33.849^{r} or "33.8499…" do NOT allow 33.879 without indication of recurring "9"
						Total 2 marks

6	$\frac{70\times40}{0.02}$ or $\frac{68\times40}{0.02}$ or $\frac{70\times43}{0.02}$ or $\frac{68\times43}{0.02}$		2	M1	for a correct expression using a suitable approximation. 0.02 is the only acceptable denominator.
	$\frac{70\times40}{0.02}=140\,000$ **or** $\frac{68\times40}{0.02}=\frac{2720}{0.02}=136\,000$ **or** $\frac{70\times43}{0.02}=\frac{3010}{0.02}=150\,500$ **or** $\frac{68\times43}{0.02}=\frac{2924}{0.02}=146\,200$	Correct figures		A1	If student says 'no' then do not award the A mark rounded expression and evaluated answer required Intermediate step required unless rounded to 1sf For each, ×50 (oe) may be seen in intermediate step. eg $\frac{68\times40}{0.02}=2720\times50=136\,000$
					Total 2 marks

7	$4.3^2 + 6.4^2$ or 59.45		4	M1	for squaring and adding
	$\sqrt{4.3^2 + 6.4^2}$ or $\sqrt{59.45}$ or 7.71(038…) or 7.7			M1	dep 1st M1 for square rooting
	e.g ('7.71' + 4.3 + 6.4) × 22 or '18.4' × 22 (=404.8) or ('8' + 4.3 + 6.4) × 22 or '18.7' × 22 or '19' × 22 or '20' × 22			M1	dep M2 for a non-rounded perimeter × 22 or 19 × 22 accept 20 × 22 oe
		$418		A1	cao
					Total 4 marks

8	15 × 24 (= 360) **or** 25 × 18 (= 450)		3	M1	may be implied by 810 seen
	$\frac{'360' + '450'}{40}$ $(= \frac{810}{40})$			M1	dep on M1
		20.25 oe		A1	for 20.25 accept 20.3 (allow 20 from correct working)
					Total 3 marks

9 (a)			2	M1	for $(x \pm 6)(x \pm 7)$
		$(x + 6)(x - 7)$		A1	for $(x + 6)(x - 7)$ or $(x - 7)(x + 6)$ isw roots given if candidate solves the quadratic = 0
(b)	$3x - 8x < 3 - 15$ or $15 - 3 < 8x - 3x$		3	M1	accept as equation or with the wrong inequality sign.
	$-5x < -12$ or $12 < 5x$			M1	accept as equation or with the wrong inequality sign.
		$x > 2.4$		A1	Accept $2.4 < x$ or $x > \frac{12}{5}$ oe allow $(-\infty, 2.4)$ award M1 M1 A0 for 2.4 with = sign or no inequality or incorrect inequality sign.
					Total 5 marks

10 (a)		0	1	B1	condone 150^0
(b)		-2	1	B1	condone 3^{-2}
					Total 2 marks

11	See appendix 1		3	M1	for $y = x$ correctly drawn solid or dashed line accepted
				M1	indep for $x = 4$ **and** $y = -2$ correctly drawn solid or dashed line accepted
		Correct region identified		A1	for correct region identified region may be shaded or left unshaded Condone missing label if region is clear and no contradictory labels
					Total 3 marks

12	$y=\frac{7-5x}{2}$ or $y=\frac{7}{2}-\frac{5}{2}x$ or $y=3.5-2.5x$ or $2y=7-5x$ oe		2	M1	for making y or $2y$ the subject Allow $y=-\frac{5}{2}x+c$ oe
		-2.5		A1	for $-\frac{5}{2}$ or -2.5
					Total 3 marks

13	$\cos 35°=\frac{15}{AB}$ or $\sin 55°=\frac{15}{AB}$ or $\frac{15}{\sin 55}=\frac{JB}{\sin 35}$ **and** $\left(AB^2=\right)("10.50")^2+15^2$ or $\tan 35°=\frac{JB}{15}$ **and** $\left(AB^2=\right)("10.50")^2+15^2$		5	M1	oe eg x for AB
	$(AB=)\frac{15}{\cos 35°}$ (=18.3…) **or** $(AB=)\frac{15}{\sin 55°}$ (=18.3…) **or** $(AB=)\sqrt{("10.50")^2+15^2}$ **or** $(AB=)\sqrt{(15\tan 35)^2+15^2}$			M1	
	'18.3' × 4 (= 73.2)			M1	dep 1st M1
	80 − '18.3' × 4 or 80 – '73.2'			M1	dep 1st M1
		6.75		A1	accept 6.75 – 6.8
					Total 5 marks

Alternative Mark Scheme for Q13 [do not mix and match with above MS]					
13	15×4 (= 60)		5	M1	
	$\cos 35° = \frac{'60'}{AE}$ or $\sin 55° = \frac{'60'}{AE}$			M1	
	$(AE =) \frac{'60'}{\cos 35°}$ (= 73.2) or $(AE =) \frac{'60'}{\sin 55°}$ (= 73.2)			M1	dep 1st M1
	80 – '73.2'			M1	
		6.75		A1	accept 6.75 – 6.8
					Total 5 marks

14	(a)	35 37 38 39 41 42 43 44 45 47 47		3	M1	Ordering values (allow 1 error) error may include missing a value May be implied by correct values for LQ **and** UQ.
					M1	LQ = 38 **and** UQ = 45 identified
			7		A1	
	(b)		January and reason using IQR	1	B1	ft from part (a) January as the IQR is lower oe ignore irrelevant statements about the median if given in addition to correct statements about IQR.
						Total 4 marks

15	$\pi \times 2.5^2 \times 15$ (= 93.75π = 294.5243...)		5	M1	for using the formula for volume of cylinder
	$21.5 = \frac{m}{"294.5243"}$			M1	for using $d = \frac{m}{v}$ with *their* intended volume *v*
	(*m* =) 21.5 × '294.5243...' (= 6332.272692)			M1	for rearranging for $m = d \times v$
	'6332.27269' ÷ 1000 × 5 (=31.661…) or '6332.27269' ÷ 6 ÷ 1000 (= 1.055…) or '6332.27269'× 5 **and** 30 × 1000 (=30 000) or 30 ÷ ('6332.27269' ÷ 1000) (= 4.7376…)			M1	for a correct calculation that would enable a conclusion to be made based on mass
		No and correct comparable figure(s)		A1	for No oe and (31.6 to 31.7 **or** 1.05 to 1.06 **or** 4.70 to 4.74) seen
					Total 5 marks

Alternative Mark Scheme for Q15					
15	$\pi \times 2.5^2 \times 15$ (= 93.75π = 294.5243...)		5	M1	for using the formula for volume of cylinder
	$21.5 = \frac{30\,000}{v}$ or $21.5 = \frac{30\,000 \div 5}{v}$			M1	for using $d = \frac{m}{v}$ with given *d* and *m*
	(*v* =) $\frac{30\,000}{21.5}$ (=1395.34…) or (*v* =) $\frac{30\,000}{21.5 \times 5}$ (=279.069…)			M1	for rearranging for $v = \frac{m}{d}$ for either one nugget, or all five nuggets.
	"1395.34" **and** "294.52" × 5 (= 1472.62) or "279.06" **and** "294.52"			M1	for correct calculations that would enable a conclusion to be made based on volumes
		No and correct comparable figure(s)		A1	awrt 3sf
					Total 6 marks

16	(a) (i)		40	2	B1	cao (may be written on the diagram)
	(ii)		Angles in same segment (are equal)		B1	**or** angles at the circumference from the same arc of the circle **or** angles on the same arc of the circle **Alternatively**: (two applications of) Opposite angles of a cyclic quadrilateral sum to 180^o
	(b)		140	1	B1	cao (may be written on the diagram)
						Total 3 marks

17	$yn^2 = n^2 + d$ **or** $y = 1 + \frac{d}{n^2}$		4	M1	
	$yn^2 - n^2 = d$ **or** $-d = n^2 - yn^2$ **or** $y - 1 = \frac{d}{n^2}$			M1	
	$n^2(y-1) = d$ **or** $-d = (1-y)n^2$			M1	for factorising n^2 from a suitable expression. or $n^2 = \frac{d}{y-1}$
		$n = \sqrt{\frac{d}{y-1}}$		A1	Accept $n = \sqrt{\frac{-d}{1-y}}$ Penalise $\pm\sqrt{\ }$
					Total 4 marks

18	(a)		(−4.5) 3 4.5 (3) 1.5 (3) 10.5	2	B2 (B1	for all correct for any two correct) No points in table but correctly plotted on grid, award mark
	(b)	(−3, −4.5) (−2,3) (−1,4.5) (0,3) (1,1.5) (2,3) (3,10.5)	Smooth curve	2	B2 (B1	for a correct smooth curve. Points or curve passing through correct values within half a small square. for at least 5 points plotted correctly; ft from table for plotting only provided B1 awarded in part (a))
	(c)			2	M1	for drawing $y = -x - 1$ with two correct points plotted and intersection with curve. **or** for stating $y = -x - 1$ **or** for $\frac{1}{2}x^3 - 2x + 3 = -x - 1$ seen
			−2.3 to −2.4		A1	ft their curve dep on M1 **and** line $y = -x - 1$ drawn
						Total 6 marks

19	$\pi \times 12^2 \times \frac{AOC}{360} (=100)$		4	M1	oe for setting up a correct expression for the area of the sector (or equation)
	$(AOC =) \frac{100 \times 360}{\pi \times 12^2} \left(= \frac{250}{\pi} \right)$			M1	for correctly rearranging for *AOC*
	(Angle *ABC* =) "79.57747" ÷ 2 (= 39.7887… or $\frac{125}{\pi}$)			M1	ft dep 1st M1 **and** '*x*' less than 360 for dividing their '*AOC*' by 2
		39.8		A1	for awrt 39.8 accept $\frac{125}{\pi}$
					Total 4 marks

20 (a)	$T = \frac{k}{m^2}$ or $Tm^2 = k$		3	M1	for a correct equation with a constant Do not allow constant = 1	
	$30 \times 0.5^2 = k$ or $30 = \frac{k}{0.5^2}$ or $k = 7.5$ or $k = \frac{15}{2}$			M1	dep on M1 for correct substitution in a correct equation	M2 for $k = 7.5$ or $k = \frac{15}{2}$
		$T = \frac{7.5}{m^2}$		A1	for $T = \frac{7.5}{m^2}$ or $T = \frac{15}{2m^2}$ SCB2 for $Tm^2 = 7.5$ or $Tm^2 = \frac{15}{2}$ or $m^2 = \frac{7.5}{T}$ or $m^2 = \frac{15}{2T}$	
(b)		750	1	B1	cao	
					Total 4 marks	

21	14 ÷ 10 (= 1.4) **or** at least two of (3.2 × 15 (=48) or 3.6 × 5 (=18) or 0.6 × 10 (=6) or 0.2 × 20 (=4) **or** at least two of (140, 480, 180, 60, 40) **or** $\frac{14}{140} = \left(\frac{1}{10}\right)$		3	M1	for any one correct frequency density or $1cm^2 = 2.5$ or association of area with frequency eg one small square = 0.1 (on vertical axis)
	14 + 3.2 × 15 + 3.6 × 5 + 0.6 × 10 + 0.2 × 20 **or** 14 + 48 + 18 + 6 + 4 **or** $(140 + 480 + 180 + 60 + 40) \times \frac{1}{10}$ **or** $900 \times \frac{1}{10}$			M1	for any correct method Allow one error in their total (error may include missing a total for a bar)
		90		A1	answer from correct working
					Total 3 marks

22	$(y-4)^2-(y-4)+y^2=10$ or $x^2-x+(x+4)^2=10$		6	M1	for substituting linear equation into the quadratic equation
	$2y^2-9y+10=0$ or $2x^2+7x+6=0$			A1	for a correct equation in the form $ax^2 + bx + c = 0$ or $ax^2 + bx = -c$ or equations of the same form but in y
	$(2y-5)(y-2)=0$ or $\frac{--9\pm\sqrt{(-9)^2-(4\times2\times10)}}{2\times2}$ or $(2x+3)(x+2)=0$ or $\frac{-7\pm\sqrt{7^2-(4\times2\times6)}}{2\times2}$			M1ft	For solving *their* 3 term 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 $\frac{-7\pm\sqrt{49-48}}{4}$ or eg $\left(x+\frac{7}{4}\right)^2-\frac{1}{16}=0$ oe $\frac{9\pm\sqrt{81-80}}{4}$ or eg $\left(y-\frac{9}{4}\right)^2-\frac{1}{16}=0$ oe
	$(-1.5, 2.5)$ and $(-2, 2)$			A1	for both pairs of coordinates oe eg $\left(\frac{-3}{2},\frac{5}{2}\right)$ accept coordinates listed as pairs, ie x_1, y_1, x_2, y_2
	$\sqrt{('-1.5'-'-2')^2+('2.5'-'2')^2}$			M1	dep on M1 for finding length of AB
		$\frac{\sqrt{2}}{2}$		A1	dep M3
					Total 6 marks

23	$\left(\frac{-1+5}{2}, \frac{6-4}{2}\right)$ or $\left(\frac{4}{2}, \frac{2}{2}\right)$ or (2, 1)		6	M1	for finding midpoint
	$\frac{-4-6}{5--1}$ or $\frac{6--4}{-1-5}$ or $-\frac{10}{6}$ or $-\frac{5}{3}$			M1	indep for finding the gradient of *PQ*
	$\frac{-1}{-\frac{10}{6}}$ or $\frac{6}{10}$ or $\frac{-1}{-\frac{5}{3}}$ or $\frac{3}{5}$ or 0.6			M1	for finding the perpendicular gradient to *PQ* (ft their stated gradient)
	$1=\frac{3}{5}(2)+c$ or $c = -\frac{1}{5}$ or $c = -\frac{2}{10}$ or $c=-0.2$			M1	dep on 1st and 3rd M1 for substituting '(2, 1)' into $y='\frac{3}{5}'x+c$ or find the value of *c* oe eg $y-'1'='\frac{3}{5}'(x-'2')$
	$y=\frac{3}{5}x-\frac{1}{5}$ or $y=0.6x-0.2$ or $5y=3x-1$			A1	for a correct equation in any form
		$3x-5y-1=0$		A1	for $3x-5y-1=0$ or $5y-3x+1=0$ or $6x-10y-2=0$ oe accept in the form $ax+by=-c$ eg $3x-5y=1$ or $5y-3x=-1$ oe
					Total 6 marks

Alternative Mark Scheme for Q23					
23	$(x+1)^2+(y-6)^2$ or $(x-5)^2+(y+4)^2$		6	M1	
	$(x+1)^2+(y-6)^2=(x-5)^2+(y+4)^2$			M1	using $PA^2 = QA^2$ (for some point A on the line)
	$x^2+2x+1+y^2-12y+36$ or $x^2-10x+25+y^2+8y+16$			M1	
	$x^2+2x+1+y^2-12y+36=x^2-10x+25+y^2+8y+16$			M1	
	eg $2x+1-12y+36=-10x+25+8y+16$ or $12x+37=20y+41$			A1	for a correct linear equation in x and y
		$3x-5y-1=0$		A1	for $3x-5y-1=0$ oe
					Total 6 marks

24	(a)	$-3\left(x^2-4x\right)+7$ or $-3\left(x^2-4x-\frac{7}{3}\right)$		4	M1	for factorising the expression to find b or $b = -3$ stated or shown clearly in answer.
		$-3\left[(x-2)^2 .....\right]$ or c = –2 $-3\left[(x-2)^2-4\right]+7$ or $-3\left[(x-2)^2-4-\frac{7}{3}\right]$			M1	or for c shown clearly in answer.
		$-3(x-2)^2+12+7$ or $-3\left[(x-2)^2-\frac{19}{3}\right]$			M1	fully correct method.
			$19-3(x-2)^2$		A1	for $19-3(x-2)^2$ oe
	(b)		(2, 19)	1	B1 ft	dep on M1 in part (a) answer must follow answer from (a) if given
						Total 5 marks

Alternative mark scheme for 24						
24	(a)	$a + bx^2 + 2bcx + bc^2$		4	M1	for multiplying out $a + b(x + c)^2$ to obtain $a + bx^2 + 2bcx + bc^2$ oe
		$b = -3$ or $2bc = 12$ or $a + bc^2 = 7$ oe			M1	for equating coefficients
		$b = -3$ and $c = -2$			M1	for correctly finding b and c
		$a = 19$	$19-3(x-2)^2$		A1	for $19-3(x-2)^2$ oe
	(b)		(2, 19)	1	B1 ft	dep on M1 in part (a)
						Total 5 marks

25	$\overrightarrow{AB} = 2\mathbf{b} - 2\mathbf{a}$ or $\overrightarrow{BA} = 2\mathbf{a} - 2\mathbf{b}$ $\overrightarrow{MN} = 10\mathbf{a} - \mathbf{b}$ or $\overrightarrow{NM} = -10\mathbf{a} + \mathbf{b}$		5	M1 for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or $\overrightarrow{MN}$ or $\overrightarrow{NM}$
	eg $\overrightarrow{MP} = -\mathbf{b} + 2\mathbf{a} + k(2\mathbf{b} - 2\mathbf{a})$ and $\overrightarrow{MP} = l(10\mathbf{a} - \mathbf{b})$ or eg $\overrightarrow{MP} = \mathbf{b} + k(2\mathbf{a} - 2\mathbf{b})$ and $\overrightarrow{MP} = l(10\mathbf{a} - \mathbf{b})$ or eg $\overrightarrow{PN} = 8\mathbf{a} + k(2\mathbf{a} - 2\mathbf{b})$ and $\overrightarrow{PN} = l(10\mathbf{a} - \mathbf{b})$ or eg $\overrightarrow{AP} = 8\mathbf{a} + k(\mathbf{b} - 10\mathbf{a})$ and $\overrightarrow{AP} = l(2\mathbf{b} - 2\mathbf{a})$ or eg $\overrightarrow{AP} = -2\mathbf{a} + \mathbf{b} + k(10\mathbf{a} - \mathbf{b})$ and $\overrightarrow{AP} = l(2\mathbf{b} - 2\mathbf{a})$ or eg $\overrightarrow{AM} = k(2\mathbf{b} - 2\mathbf{a}) + l(\mathbf{b} - 10\mathbf{a})$ and $\overrightarrow{AM} = -2\mathbf{a} + \mathbf{b}$			M2 for writing eg $\overrightarrow{MP}$ or $\overrightarrow{PN}$ or $\overrightarrow{AP}$ or $\overrightarrow{AM}$ in two different ways in terms of **a** and **b** (M1 for writing eg $\overrightarrow{MP}$ or $\overrightarrow{PN}$ or $\overrightarrow{AP}$ or $\overrightarrow{AM}$ in one way) These may be written as eg $\overrightarrow{PM}$ in place of $\overrightarrow{MP}$
	eg $2-2k=10\lambda$ and $-1+k=-\lambda$ (from $\overrightarrow{MP}$ 1st) or eg $2k=10\lambda$ and $1-2k=-\lambda$ (from $\overrightarrow{MP}$ 2nd) or eg $8+2k=10\lambda$ and $-2k=-\lambda$ (from $\overrightarrow{PN}$) or eg $8-10k=-2\lambda$ and $k=2\lambda$ (from $\overrightarrow{AP}$ 1st) or eg $-2+10k=-2\lambda$ and $1-k=2\lambda$ (from $\overrightarrow{AP}$ 2nd) or eg $-2k-10\lambda=-2$ and $2k+\lambda=1$ (from $\overrightarrow{AM}$)			M1 dep M3 for writing a pair of equations using their variables. $\overrightarrow{MP}$ (1st) leads to $\lambda=\frac{1}{9}, k=\frac{4}{9}$ $\overrightarrow{MP}$ (2nd) leads to $\lambda=\frac{1}{9}, k=\frac{5}{9}$ $\overrightarrow{PN}$ leads to $\lambda=\frac{8}{9}, k=\frac{4}{9}$ $\overrightarrow{AP}$ (1st) leads to $\lambda=\frac{4}{9}, k=\frac{8}{9}$ $\overrightarrow{AP}$ (2nd) leads to $\lambda=\frac{4}{9}, k=\frac{1}{9}$ $\overrightarrow{AM}$ leads to $\lambda=\frac{1}{9}, k=\frac{4}{9}$
		4 : 5		A1 cao
				Total 5 marks

26	$\left(2+\sqrt{5}\right)\times AC=(2\sqrt{5})\times\left(2\sqrt{5}+4+\sqrt{5}\right)$ or $\left(2+\sqrt{5}\right)\times AC=(2\sqrt{5})\times\left(3\sqrt{5}+4\right)$ or $\left(2+\sqrt{5}\right)\times(AB+2+\sqrt{5})=(2\sqrt{5})\times\left(2\sqrt{5}+4+\sqrt{5}\right)$		5	M1	for using the intersecting chord theorem correctly eg may label $AB=x$ or $AC=x$ oe
	$(AC=)\dfrac{\left(2\sqrt{5}\right)\times\left(2\sqrt{5}+4+\sqrt{5}\right)}{\left(2+\sqrt{5}\right)}$ or $(AC=)\dfrac{\left(30+8\sqrt{5}\right)}{\left(2+\sqrt{5}\right)}$			M1	dep 1st M1 for rearranging for AC may use $AB+2+\sqrt{5}$ on LHS
	$(AC=)\dfrac{\left(30+8\sqrt{5}\right)}{\left(2+\sqrt{5}\right)}\times\dfrac{\left(2-\sqrt{5}\right)}{\left(2-\sqrt{5}\right)}$ or $(AB=)\dfrac{\left(21+4\sqrt{5}\right)}{\left(2+\sqrt{5}\right)}\times\dfrac{\left(2-\sqrt{5}\right)}{\left(2-\sqrt{5}\right)}$			M1	indep for multiplying by the conjugate of the denominator of *their* fraction, so long as fraction in the form $\dfrac{a+b\sqrt{5}}{c+d\sqrt{5}}$
	$(AC=)\dfrac{60-30\sqrt{5}+16\sqrt{5}-40}{4-5}$ $\left(=14\sqrt{5}-20\right)$ or $(AB=)\dfrac{42-21\sqrt{5}+8\sqrt{5}-20}{4-5}$			M1	dep 3rd M1 for multiplying out the numerator
	$(AB=)\dfrac{20-14\sqrt{5}}{-1}-\left(2+\sqrt{5}\right)$	$13\sqrt{5}-22$		A1	allow $p = 13$ and $q = -22$
					Total 5 marks