

International GCSE Maths					
Apart from questions 5(b), 15, 17, 18, 19, 23 and 24 (where the mark scheme states otherwise) the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method					
Q	Working	Answer	Mark	Notes	
1	e.g. $0.7 \times 20\,160$ oe (= 14 112) or $0.3 \times 20\,160$ oe (= 6048)		4	M1	
	e.g. “14 112” $\div (9 + 5 + 2)$ (= 882) or $(20\,160 - \text{“6048”}) \div (9 + 5 + 2)$ (= 882)			M1	M2 for $\frac{9-2}{9+5+2} \times \text{“14 112”}$ oe
	e.g. $9 \times \text{“882”} - 2 \times \text{“882”}$			M1	
		6174		A1	
				Total 4 marks	

2	(a)		$70 < s \leq 80$	1	B1
	(b)	$10 \times 45 + 16 \times 55 + 19 \times 65 + 23 \times 75 + 12 \times 85$ or $450 + 880 + 1235 + 1725 + 1020 (= 5310)$		4	M2 $f \times d$ for at least 4 products with correct mid-interval values and intention to add. If not M2 then award M1 for d used consistently for at least 4 products within interval (including end points) and intention to add or for at least 4 correct products with correct mid-interval values with no intention to add
		"5310" $\div 80$			M1 dep on at least M1 allow division by their $\sum f$ provided addition or total under column seen
			66.4		A1 accept 66.37 – 66.4
					Total 5 marks

3	e.g. $30 \times 20 \times 125 (= 75\,000)$ or $85 \times 40 \times 125 (= 425\,000)$ or $(60 \times 30 + (85 - 30) \times 40) \times 125 (= 500\,000)$ oe		4	M1	for a method to find the volume of water already pumped out or the volume of water left or the total volume of the container
	"75 000" $\div$ 1.5 (= 50 000) or "75 000" $\div$ 90 (= 833.3... or $\frac{2500}{3}$) or "425000" $\div$ "75000" (= 5.66... or $\frac{17}{3}$) or "500000" $\div$ "75000" (= 6.66... or $\frac{20}{3}$)			M1	M2 for $\frac{"425000"}{"75000"} \times 1.5$ oe (= 8.5) or $\frac{"500000"}{"75000"} \times 1.5$ oe (= 10)
	"425 000" $\div$ "50 000" (= 8.5) or "425 000" $\div$ ("833.3..." $\times$ 60) oe (= 8.5) or "5.66..." $\times$ 1.5 (= 8.5) or "6.66..." $\times$ 1.5 (= 10)			M1	
		20 30		A1	Allow 8 30 (pm)
				Total 4 marks	

4	(i)		21, 27	1	B1
	(ii)		21, 23, 24, 25, 27, 29	1	B1
					Total 2 marks

5	(a)		$5y^3(3y + 4u)$	2	B2 for $5y^3(3y + 4u)$ (B1 for $5y(3y^3 + 4uy^2)$ or $5y^2(3y^2 + 4uy)$ or $y^2(15y^2 + 20uy)$ or $y^3(15y + 20u)$ or $5y^3(\dots)$ where there is only one mistake in the brackets)
	(b)	$4 \times (4 - 3x) = 5 - 8x$ oe or $16 - 12x = 5 - 8x$ oe or $4 - 3x = \frac{5}{4} - 2x$ oe		3	M1 for removal of fraction in a correct equation
		e.g. $16 - 5 = 12x - 8x$ or $11 = 4x$ oe or $4 - \frac{5}{4} = 3x - 2x$			M1 for terms in x on one side and numbers on the other side in an equation, allow correct rearrangement of their equation in the form $ax + b = cx + d$
			2.75		A1 (dep on M1) oe e.g. $2\frac{3}{4}$ or $\frac{11}{4}$
					Total 5 marks

6	(a)		2.84×10^9	1	B1
	(b)		0.000 25	1	B1
					Total 2 marks

7	(a)	for $0.035 \times 40\,000$ oe (= 1400) or $1.035 \times 40\,000$ oe (= 41 400)	OR		3	M1	for finding 3.5% or 103.5% of 40 000	OR M2 for $40\,000 \times 1.035^3$ or $40\,000 \times 1.035^4$ (= 45 900.92) (M1 for $40\,000 \times 1.035^2$ (= 42 849))
		$1.035 \times$ “41 400” oe (= 42 849) $1.035 \times$ “42 849” oe (= 44 348.72)	$40\,000 \times 1.035^3$			M1	for completing method to find total amount in the account	
				44 349		A1	accept 44 348 – 44 349	
							SC: if no other marks gained award M1 for $0.105 \times 40\,000$ oe or 4200 or 44 200 accept $(1 + 0.035)$ as equivalent to 1.035 throughout	
	(b)	e.g. $30\,481 \div (1 - 0.065)$ or $30\,481 \div 0.935$			3	M2	for a complete method	
						(M1)	for $30\,481 \div (100 - 6.5)$ (= 326) or $(100 - 6.5)\% = 30\,481$ or $93.5\% = 30\,481$ or e.g. $(1 - 0.065)x = 30\,481$	
				32 600		A1		
							Total 6 marks	

8	$2 \times \pi \times 7 (= 43.982... \text{ or } 14\pi)$ or $(2 \times \pi \times 7) \div 2 (= 21.991... \text{ or } 7\pi)$ or $2 \times \pi \times 9 (= 56.548... \text{ or } 18\pi)$ or $(2 \times \pi \times 9) \div 2 (= 28.274... \text{ or } 9\pi)$		3	M1 for finding the circumference of either the full circle or the length of the arc for either semicircle
	e.g. “21.991” + “28.274” (= 50.26...) or “ 7π ” + “ 9π ” (= 16π) or “21.991” + “28.274” + 2 (= 52.26...) or “ 7π ” + “ 9π ” + 2 (= 52.26...) or “21.991” + “28.274” + 2 + 2 or “ 7π ” + “ 9π ” + 2 + 2			M1 for a method to find the length of the two arcs with intention to add
		54.3		A1 accept 54.2 – 54.3
				Total 3 marks

9	(a)		$16x^{12}y^{20}$	2	B2 B1 for an answer in the form ax^ny^m with 2 correct from $a = 16, n = 12, m = 20$
	(b)(i)	$(x \pm 9)(x \pm 4)$		2	M1 for $(x \pm 9)(x \pm 4)$ or for $(x + a)(x + b)$ where $ab = -36$ or $a + b = 5$
			$(x + 9)(x - 4)$		A1
	(ii)		-9, 4	1	B1 ft from (b)(i)
					Total 5 marks

10	e.g. $\sin 65 = \frac{16}{AB}$ or $\cos 25 = \frac{16}{AB}$ or $\frac{AB}{\sin 90} = \frac{16}{\sin 65}$ or $\tan 65 = \frac{16}{AD}$ or $\tan 25 = \frac{AD}{16}$ or $\frac{AD}{\sin 25} = \frac{16}{\sin 65}$		4	M1 for a correct trig ratio for AB or AD accept $180 - 90 - 65$ for 25
	e.g. $(AB =) \frac{16}{\sin 65} (= 17.654\dots)$ or $(AB =) \frac{16}{\cos 25} (= 17.654\dots)$ or $(AB =) \frac{16 \sin 90}{\sin 65} (= 17.654\dots)$ and $(AD =) \frac{16}{\tan 65} (= 7.460\dots)$ or $(AD =) 16 \times \tan 25 (= 7.460\dots)$ or $(AD =) \frac{16 \sin 25}{\sin 65} (= 7.460\dots)$			M1 for finding AB and AD Allow use of Pythagoras $(AD =) \sqrt{17.654\dots^2 - 16^2} (= 7.460\dots)$ or $(AB =) \sqrt{7.460\dots^2 + 16^2} (= 17.654\dots)$
	$(“17.654\dots” \times 2) + (“7.460\dots” \times 2)$ oe			M1 for a complete method to find the perimeter
		50.2		A1 accept 49.6 – 50.6
				Total 4 marks

11	(a)			2	M1 for use of cf at 45
			146		A1 accept in the range 145 – 147
	(b)	$93.75 \div 3.75 (= 25)$		3	M1
		Using cf diagram at 90 – “25” (= 65)			M1 for use of cf at “65”
			151		A1 accept in the range 150 – 152
					Total 5 marks

12	(a)	$\frac{4(x+1)-3(x-2)}{(x-2)(x+1)}$ or $\frac{4(x+1)}{(x-2)(x+1)} - \frac{3(x-2)}{(x-2)(x+1)}$		3	M1 for expressing both fractions correctly with a common denominator.
		$\frac{4x+4-3x+6}{(x-2)(x+1)} \text{ or } \frac{4x+4-3x+6}{x^2-x-2}$			M1 for removing brackets in a single fraction with a correct denominator. Allow denominator to be expanded. Allow one error in the expansion of the numerator.
			$\frac{x+10}{(x-2)(x+1)}$		A1 accept $\frac{x+10}{x^2-x-2}$ oe
	(b)	$2x(x-5) = 2x^2 - 10x$ or $2x(x-3) = 2x^2 - 6x$ or $(x-5)(x-3) = x^2 - 5x - 3x + 15 (= x^2 - 8x + 15)$		3	M1 for multiplying 2x by a bracket with both terms correct or the 2 brackets with at least 3 out of 4 terms correct or at least 2 out of 3 terms correct
		$(2x^2 - 10x)(x-3) = 2x^3 - 6x^2 - 10x^2 + 30x$ or $(2x^2 - 6x)(x-5) = 2x^3 - 10x^2 - 6x^2 + 30x$ or $2x(x^2 - 5x - 3x + 15) = 2x^3 - 10x^2 - 6x^2 + 30x$ or $2x(x^2 - 8x + 15) = 2x^3 - 16x^2 + 30x$			M1 (dep) for multiplying the product of 2x and the 1 st bracket (ft from the 1 st stage) by the 2 nd bracket and getting at least 3 out of 4 terms correct or multiplying the product of the 2 brackets (ft from the 1 st stage) by the 2x, and getting at least 3 out of 4 or 2 out of 3 terms correct
			$2x^3 - 16x^2 + 30x$		A1
Total 6 marks					

13	(a)	$\frac{8-4}{5-9} \left(= \frac{12}{-4} \right)$ oe or $\frac{-4-8}{9-5} \left(= \frac{-12}{4} \right)$ oe		2	M1 condone correct gradient embedded in an equation e.g. $y = -3x + c$ or expression e.g. $-3x$ or for an answer of 3
			-3		A1
	(b)		$\frac{1}{4}$	1	B1 accept 0.25 or $-\frac{1}{-4}$ oe
					Total 3 marks

14	(a)	0.6×0.9		2	M1 oe
			0.54		A1 oe e.g. $\frac{27}{50}, \frac{54}{100}, 54\%$
	(b)	$0.6 \times 0.1 (= 0.06)$ or $0.4 \times 0.25 (= 0.1)$ or $0.4 \times 0.75 (= 0.3)$		3	M1 oe
		$0.6 \times 0.1 + 0.4 \times 0.25$ or $1 - (0.4 \times 0.75) = \text{“0.54”}$			M1 oe, ft their answer from (a)
			0.16		A1 oe e.g. $\frac{4}{25}, \frac{8}{50}, \frac{16}{100}, 16\%$
					Total 5 marks

15	9.55 or 9.65 or 3.75 or 3.85 or 1.835 or 1.845		3	B1 accept 9.649 for 9.65, 3.849 for 3.85, 1.8449 for 1.845
	$a = \frac{UB_v - LB_u}{LB_t}$ e.g. $a = \frac{9.65 - 3.75}{1.835} (= 3.2152...)$			M1 for correct substitution of $9.6 < UB_v \leq 9.65$ and $3.75 \leq LB_u < 3.8$ and $1.835 \leq LB_t < 1.84$
		3.22		A1 accept 3.21 – 3.22 from correct working
				Total 3 marks

16	$(BC^2 =) 150^2 + 275^2 - (2 \times 150 \times 275 \times \cos 120) (= 139\,375)$		5	M1 for correct substitution into the cosine rule
	$(BC =) \sqrt{150^2 + 275^2 + 41250}$ oe or $\sqrt{139375}$ or $25\sqrt{223}$ or 373....			M1 for correct order of operations and square root
	e.g. $\frac{\sin ABC}{275} = \frac{\sin 120}{"373..."}$ or $275^2 = 150^2 + "373..."^2 - (2 \times 150 \times "373..." \times \cos ABC)$ or $\cos ABC = \frac{150^2 + "373..."^2 - 275^2}{2 \times 150 \times "373..."}$ or $\frac{\sin ACB}{150} = \frac{\sin 120}{"373..."}$ or $150^2 = 275^2 + "373..."^2 - (2 \times 275 \times "373..." \times \cos ACB)$ or $\cos ACB = \frac{275^2 + "373..."^2 - 150^2}{2 \times 275 \times "373..."}$			M1 (dep on 1 st M1) ft 373... for a correct trig statement involving angle ABC or angle ACB
	$(ABC =) \sin^{-1} \left(\frac{\sin 120}{"373..." \times 275} \right) (= 39.6...)$ or $(ABC =) \cos^{-1} \left(\frac{150^2 + "373..."^2 - 275^2}{2 \times 150 \times "373..." \times 275} \right) (= 39.6...)$ or $(ACB =) \sin^{-1} \left(\frac{\sin 120}{"373..." \times 150} \right) (= 20.3...)$ or $(ACB =) \cos^{-1} \left(\frac{275^2 + "373..."^2 - 150^2}{2 \times 275 \times "373..." \times 150} \right) (= 20.3...)$			M1 for a complete method to find angle ABC or angle ACB
		140		A1 accept 140 – 140.4
				Total 5 marks

17	e.g. $(V=) \frac{1}{2} \left(\frac{4}{3} \pi x^3 \right) + \pi x^2 (20 - 4x)$ or $(V=) \frac{2}{3} \pi x^3 + 20\pi x^2 - 4\pi x^3$		5	M1 for a correct expression
	e.g. $\frac{1}{3} \pi y = \frac{1}{2} \left(\frac{4}{3} \pi x^3 \right) + \pi x^2 (20 - 4x)$ or $\frac{1}{3} \pi y = \frac{2}{3} \pi x^3 + 20\pi x^2 - 4\pi x^3$			M1 for a correct equation
	$y = 60x^2 - 10x^3$ oe			A1 for writing y in terms of x
	e.g. $\left(\frac{dy}{dx} = \right) 120x - 30x^2 = 0$ oe			M1 for differentiating their $ax^2 + bx^3$ and equating to 0
		320		A1 (dep on M3) cao
				Total 5 marks

18	e.g. $40 + 8\sqrt{x} - 5\sqrt{x} - \sqrt{x}\sqrt{x}$ or $40 + 8\sqrt{x} - 5\sqrt{x} - (\sqrt{x})^2$ or $40 + 8\sqrt{x} - 5\sqrt{x} - x$ or $40 + 3\sqrt{x} - x$		3	M1 for a correct expansion with at least 3 out of 4 terms correct oe or all 3 terms correct
		$x = 19$		A1 (dep on M1) for $x = 19$
		$y = 3$		B1 for $y = 3$
				Total 3 marks

19	$(1-2y)^2 - 9y - (1-2y) = 2y^2 - 12$	$x^2 - 9\left(\frac{1-x}{2}\right) - x = 2\left(\frac{1-x}{2}\right)^2 - 12$	5	M1 substitution of linear equation into quadratic
	e.g. $2y^2 - 11y + 12 (= 0)$ oe allow $2y^2 - 11y = -12$ oe	e.g. $x^2 + 9x + 14 (= 0)$ oe allow $x^2 + 9x = -14$ oe		A1 (dep on M1) writing the correct quadratic expression in the form $ax^2 + bx + c (= 0)$ allow $ax^2 + bx = c$
	e.g. $(2y-3)(y-4)(=0)$ $(y =) \frac{11 \pm \sqrt{(-11)^2 - 4 \times 2 \times 12}}{2 \times 2}$ e.g. $2 \left[\left(y - \frac{11}{4} \right)^2 - \left(\frac{11}{4} \right)^2 \right] = -12$ oe	e.g. $(x+7)(x+2)(=0)$ $(x =) \frac{-9 \pm \sqrt{9^2 - 4 \times 1 \times 14}}{2}$ e.g. $\left(x + \frac{9}{2} \right)^2 - \left(\frac{9}{2} \right)^2 = -14$		M1 (dep on M1) for a complete method to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{11 \pm \sqrt{121-72}}{4}$ or $\frac{-9 \pm \sqrt{81-56}}{2}$)
	$y = \frac{3}{2}$ oe and $y = 4$	$x = -7$ and $x = -2$		A1 (dep on M1) both x -values or both y -values
		$x = -2,$ $y = \frac{3}{2}$ oe and $x = -7,$ $y = 4$		A1 (dep on first M1) must be paired correctly
				Total 5 marks

20	$\sqrt[3]{\frac{4352}{1836}}$ or $\frac{4}{3}$ or 1.33(33...) or 4:3 or $\sqrt[3]{\frac{1836}{4352}}$ or $\frac{3}{4}$ or 0.75 or 3:4		3	M1 for a correct length scale factor or a correct length ratio
	e.g. $1120 \div \left(\frac{4}{3}\right)^2$ oe or $1120 \times \left(\frac{3}{4}\right)^2$ oe			M1 (dep on M1) for a correct method to work out the surface area of A
		630		A1
				Total 3 marks

21	(a)(i)		$(-12, 15)$	1	B1
	(ii)		$(-9, 5)$	1	B1
	(b)		$a = 2$ and $b = 90$	2	B2 for both values correct (B1 for $a = 2$ or $b = 90$ or $a = -2$ and $b = -90$)
					Total 4 marks

22	$y = (x-4)^2 - 4^2 \quad (+5) \text{ oe or } x = (y-4)^2 - 4^2 \quad (+5)$		3	M1 for a correct first step in order to complete the square
	$y = 4 \pm \sqrt{11+x} \text{ or } x = 4 \pm \sqrt{11+y}$			A1 allow $y = 4 + \sqrt{11+x}$ or $x = 4 + \sqrt{11+y}$
		$4 - \sqrt{x+11}$		A1 oe
				Total 3 marks

22 ALT	$x^2 - 8x + (5 - y) = 0$ $(x =) \frac{8 \pm \sqrt{(-8)^2 - 4 \times 1 \times (5 - y)}}{2 \times 1}$ or $y^2 - 8y + (5 - x) = 0$ $(y =) \frac{8 \pm \sqrt{(-8)^2 - 4 \times 1 \times (5 - x)}}{2 \times 1}$		3	M1 for a correct first step in preparation for use of quadratic formula and substitution into the quadratic formula (allow one sign error)
	$y = 4 \pm \sqrt{11+x} \text{ or } x = 4 \pm \sqrt{11+y}$			A1 allow $y = 4 + \sqrt{11+x}$ or $x = 4 + \sqrt{11+y}$
		$4 - \sqrt{x+11}$		A1 oe
				Total 3 marks

22 ALT	Using $ax^2 + bx + c = a(x + p)^2 + q$			
	$\left(p = \frac{b}{2a}\right) = \frac{-8}{2} (= -4)$ and $q = (4)^2 - 8(4) + 5 (= -11)$		3	M1 for finding p and q
	$y = 4 \pm \sqrt{11 + x}$ or $x = 4 \pm \sqrt{11 + y}$			A1 allow $y = 4 + \sqrt{11 + x}$ or $x = 4 + \sqrt{11 + y}$
		$4 - \sqrt{x + 11}$		A1 oe
				Total 3 marks

23	$\overrightarrow{AB} = 2\mathbf{b} - 2\mathbf{a}$ oe or $\overrightarrow{BA} = 2\mathbf{a} - 2\mathbf{b}$ oe or $\overrightarrow{AM} = \mathbf{b} - \mathbf{a}$ oe or $\overrightarrow{MA} = \mathbf{a} - \mathbf{b}$ oe or $\overrightarrow{BM} = \mathbf{b} - \mathbf{a}$ oe or $\overrightarrow{MB} = \mathbf{a} - \mathbf{b}$ oe		6	M1 for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ or $\overrightarrow{AM}$ or $\overrightarrow{MA}$ or $\overrightarrow{BM}$ or $\overrightarrow{MB}$
	e.g. $\overrightarrow{OM} = 2\mathbf{a} + (\mathbf{b} - \mathbf{a}) (= \mathbf{a} + \mathbf{b})$ oe or $\overrightarrow{MO} = (\mathbf{b} - \mathbf{a}) - 2\mathbf{b} (= -\mathbf{a} - \mathbf{b})$ oe or $\overrightarrow{AN} = \frac{4}{3}\mathbf{b} - 2\mathbf{a}$ oe or $\overrightarrow{NA} = 2\mathbf{a} - \frac{4}{3}\mathbf{b}$ oe			M1 for finding $\overrightarrow{OM}$ or $\overrightarrow{MO}$ or $\overrightarrow{AN}$ or $\overrightarrow{NA}$
	e.g. $\overrightarrow{OP} = 2\mathbf{a} + \lambda\left(\frac{4}{3}\mathbf{b} - 2\mathbf{a}\right)$ oe or $\overrightarrow{OP} = \frac{4}{3}\mathbf{b} + \lambda\left(2\mathbf{a} - \frac{4}{3}\mathbf{b}\right)$ oe or $\overrightarrow{OP} = \mu(\mathbf{a} + \mathbf{b})$ oe OR $\overrightarrow{MP} = \mathbf{a} - \mathbf{b} + k\left(\frac{4}{3}\mathbf{b} - 2\mathbf{a}\right)$ oe or $\overrightarrow{MP} = \mathbf{b} - \mathbf{a} - \frac{2}{3}\mathbf{b} + k\left(2\mathbf{a} - \frac{4}{3}\mathbf{b}\right)$ oe or $\overrightarrow{MP} = t(-\mathbf{a} - \mathbf{b})$ oe			M1 for finding $\overrightarrow{OP}$ or $\overrightarrow{PO}$ or $\overrightarrow{MP}$ or $\overrightarrow{PM}$
	e.g. $2\mathbf{a} + \lambda\left(\frac{4}{3}\mathbf{b} - 2\mathbf{a}\right) = \mu(\mathbf{a} + \mathbf{b})$ oe or $\frac{4}{3}\mathbf{b} + \lambda\left(2\mathbf{a} - \frac{4}{3}\mathbf{b}\right) = \mu(\mathbf{a} + \mathbf{b})$ oe or $\mathbf{a} - \mathbf{b} + k\left(\frac{4}{3}\mathbf{b} - 2\mathbf{a}\right) = t(-\mathbf{a} - \mathbf{b})$ oe or $\mathbf{b} - \mathbf{a} - \frac{2}{3}\mathbf{b} + k\left(2\mathbf{a} - \frac{4}{3}\mathbf{b}\right) = t(-\mathbf{a} - \mathbf{b})$ oe			M1 for setting up an equation for $\overrightarrow{OP}$ or $\overrightarrow{MP}$
	$\mu = \frac{4}{5}$ or $t = \frac{1}{5}$			M1 for finding μ or t for either $\overrightarrow{OP} = \mu\overrightarrow{OM}$ or $\overrightarrow{MP} = t\overrightarrow{MO}$
		4 : 1		A1 cao (dep on M3)
				Total 6 marks

24	$\frac{2n}{2}[2a + (2n-1)d] \text{ oe}$		4	M1 for a correct expression for S_{2n}
	$\frac{2n}{2}[2a + (2n-1)d] = 4 \times \frac{n}{2}[2a + (n-1)d] \text{ oe}$			M1 dep on M1 for setting up a correct equation for $S_{2n} = 4 \times S_n$
	$2a - d = 4a - 2d \text{ oe}$			M1 for a correct linear expression in a and d
		$\frac{d}{2}$		A1 (dep on M2) for $\frac{d}{2} \text{ oe}$
				Total 4 marks