

Apart from Questions 1(c), 5, 6(c), 20 and 21 (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.				
Question	Working	Answer	Mark	Notes
1 (a)		$2p(2 + 3q)$	2	B2 If not B2 then award B1 for $2(2p + 3pq)$ or $p(4 + 6q)$ or $2p$ (a two term expression) or $x(2 + 3q)$ where $x \neq 2p$
(b)	$e^2 + 3e - 5e - 15$			M1 for 3 correct terms or for 4 correct terms ignoring signs or $e^2 - 2e + k$ for non-zero k or $\dots - 2e - 15$
(c)	$5y = 2y + 1$ or $y = \frac{2y}{5} + \frac{1}{5}$ E.g. $5y - 2y = 1$ or $3y = 1$ or $3y - 1 = 0$ or $\frac{3y}{5} = \frac{1}{5}$	$e^2 - 2e - 15$	2	A1 M1 for a correct first step
		$\frac{1}{3}$ oe	3	M1 for collecting terms in y in a correct equation A1 dep on at least M1 for $\frac{1}{3}$ oe e.g. $0.\dot{3}$, $0.3333\dots$

Question	Working	Answer	Mark	Notes
2 (a)		Rotation, 90° clockwise, centre $(-2, 3)$	3	B1 for rotation B1 90° clockwise or -90° (or 270° anticlockwise) B1 (centre) $(-2, 3)$ Note: Do not accept $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ for centre Award no marks is more than one transformation explicitly stated (the sight of a vector is not a second transformation) eg. moved and then rotated; rotation and translation cao
(b)		Triangle at $(-2, 2)$, $(-2, 4)$, $(-1, 4)$	1	B1
(c)		Triangle at $(-2, 1)$, $(-2, 3)$, $(-1, 3)$	2	B2 If not B2 then award B1 for a triangle of the correct size and orientation or the wrong size but enlarged correctly from $(-4, 2)$ with a sf other than 0.5 e.g. a triangle at $(4, -2)$, $(4, 6)$, $(8, 6)$

Question	Working	Answer	Mark	Notes
3	$1 - (0.15 + 0.26 + 0.33)$ or $1 - 0.74$ $(=0.26)$ $(P(\text{yellow}) =) \frac{0.26 - 0.06}{2}$ or 0.1 150×0.1	15	4	M1 can be implied by two values where $P(\text{brown}) + P(\text{yellow}) = 0.26$ (may be seen in table) M1 for a complete method to find $P(\text{yellow})$ M1 independent mark Award for $150 \times p$ where $0 < p < 1$ A1 NB: An answer of $\frac{15}{150}$ scores M3 A0

Question	Working	Answer	Mark	Notes
4 (a)	$1236.5 - 1126.5 \text{ or } 110 \text{ or } \frac{1236.5}{1126.5} \text{ or } 1.09(7647\dots)$ or $\frac{1236.5}{1126.5} \times 100 \text{ or } 109(7647\dots)$ $\frac{1236.5 - 1126.5}{1126.5} \text{ or } \frac{110}{1126.5}$ or $\left(\frac{1236.5}{1126.5} - 1 \right) \text{ or } (1.09(764\dots) - 1) \text{ or } \frac{1236.5}{1126.5} \times 100 - 100$ or 0.0976(475...)			M1
(b)	$1126.5 \times 1.19 \text{ oe}$	9.76	3	M1 for method that would result in 9.76... or 0.0976... A1 for 9.76 - 9.765 M2 if not M2 then award M1 for $\frac{19}{100} \times 1126.5 \text{ oe } 214(.035)$
		1341	3	A1 for 1340 – 1342

Question	Working	Answer	Mark	Notes
5	E.g. $4x + 15 + 30x - 5 = 180$ OR $20x + 45 + 4x + 15 = 180$ OR $4x + 15 + 20x + 45 = 180$ OR $30x - 5 = 20x + 45$ $x = 5$			M1 for forming an appropriate equation
	E.g. $20 \times "5" + 45 (=145)$ or $4 \times "5" + 15 (=35)$ or $30 \times "5" - 5 (=145)$			A1 dep on previous M1
	OR E.g. $4x + 15 + 30x - 5 = 180$ AND $30x - 5 = 20x + 45$			M1 for substituting their value for x into the expression NOT used to form the equation solved
	E.g. $AFC = 145$ and $FCD = 145$ OR $AFC = 145$ and $BCF = 35$ OR $x = 5$ from the solution of two equations			OR forms a second equation in x
		Shown correctly with reasons	5	A1 dep on previous M1 NB : It must be clear which angles are being found B1 For full reasons: Alternate angles are equal and <u>angles in a straight line</u> add to <u>180°</u> OR Allied angles (or co-interior) add to <u>180°</u> and <u>angles in a straight line</u> add to <u>180°</u>

Question	Working	Answer	Mark	Notes
6				
(a)		(6), 2, (0), (0), (2), 6	1	B1 For both entries correct
(b)	(0, 6), (1, 2), (2, 0), (3, 0), (4, 2), (5, 6)			M1 for at least 5 points plotted correctly (ft their table)
(c)	$x^2 - 5x + 6 = x - 1$	Correct curve	2	A1 for a correct curve
				M1 or for $y = x - 1$
				M1 for $y = x - 1$ drawn
7				
(a)		1.6 and 4.4	3	A1 dep on M2 ft from their graph in (b) if at least 1 mark scored in (b)
(b)	Eg $1.88 \times 10^7 + 3.10 \times 10^8 + 2.64 \times 10^8 + 7.18 \times 10^7$ or $18\,800\,000 + 310\,000\,000 + 264\,000\,000 + 71\,800\,000$ with at least 3 numbers correct	71 800 000	1	B1
(c)		6.646×10^8 oe 9.88×10^6	2 1	M1 for a complete method or for digits 6646 A1 for 6.646×10^8 oe eg 664 600 000 B1

Question	Working	Answer	Mark	Notes
8	$\frac{1}{2} \times 5 \times h = 12$ oe $\frac{1}{2} \times 2.5 \times h = 6$ oe or $h = 4.8$ $(x =) \sqrt{2.5^2 + "4.8^2"}$ or $(x =) \sqrt{"29.29"}$ or 5.41(202...)	15.8	4	M1 NB: 4.8 may be seen on the diagram M1 ft the candidate's value for height for this mark (award of this mark does not depend on award of previous mark) M1 dep on previous M1 A1 for 15.8 – 15.83

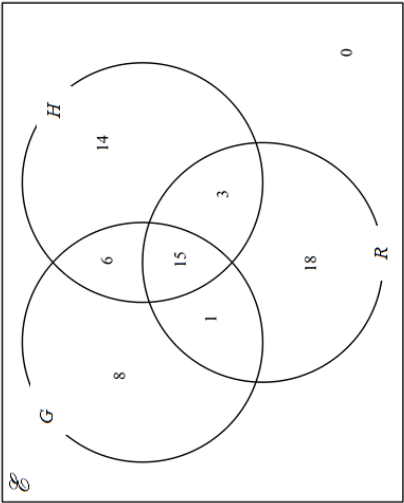
Question	Working	Answer	Mark	Notes
9				
(a)		3, 19, 43, 53, 58, 60	1	B1
(b)				M1 ft from (a) if only one addition error for at least 4 points plotted correctly at end of interval or for all 6 points plotted consistently within each interval in the frequency table at the correct height (Eg. using values of 5, 15, 25 etc on x axis)
(c)	15 and 45 indicated on the cumulative frequency axis and readings taken from speed axis	correct cf graph	2	A1 accept curve or line segments accept curve which is not joined to (0,0)
		13 – 15	2	M1 ft from a cf graph for a correct method to find LQ and UQ and intention to subtract Eg for a correct reading from 45/45.75 and 15/15.25 from vertical axis to find LQ and UQ and an intention to subtract
				A1 accept 13 – 15 ft from a cf graph

Question	Working	Answer	Mark	Notes
10	Working with CD and then triangle ABD E.g. $\tan 20 = \frac{CD}{13}$			M1 for a correct statement or equation including CD as the only variable E.g. $CD^2 = \left(\frac{13}{\cos 20}\right)^2 - 13^2$
	E.g. ($CD =$) $13 \tan 20$ or $4.7(316\dots)$			M1 for a correct method to find CD E.g. $\sqrt{\left(\frac{13}{\cos 20}\right)^2 - 13^2}$
	E.g. $\tan(BAD) = \frac{8 + \frac{4.73}{13}}{13}$ or $\tan(BAD) = 0.97(93\dots)$			M1 for a correct statement or equation including angle BAD as the only variable
	E.g. ($BAD =$) $\tan^{-1}("0.979")$ or $44.4(024\dots)$			M1 for a correct method to find angle BAD
		24.4	5	A1 for 24.3 - 24.41 Award M1A1M1M1A0 for an answer in the range 44.3 – 44.41

Question	Working	Answer	Mark	Notes
10	Alternative mark scheme – working with AC and then triangle ABC E.g. $\cos 20 = \frac{13}{AC}$ E.g. $(AC =) \frac{13}{\cos 20}$ or $13.8(3\dots)$ E.g. $(AB =) \sqrt{13.8^2 + 8^2 - 2 \times 13.8 \times 8 \times \cos(110)}$ $(=18.1(9\dots))$ or 18.2 E.g. $\frac{\sin BAC}{8} = \frac{\sin 110}{18.1}$ or $8^2 = 13.8^2 + 18.1^2 - 2 \times 13.8 \times 18.1 \times \cos BAC$	24.4	5	M1 for a correct statement or equation including AC as the only variable E.g. $AC^2 = 13^2 + (13 \tan 20)^2$ M1 for a correct method to find AC E.g. $\sqrt{13^2 + (13 \tan 20)^2}$ M1 for a correct method to find AB M1 for a correct statement or equation including angle BAC as the only variable A1 for ans in range 24.3 - 24.41 Award M4A0 for an answer in the range 44.3 – 44.41

Question	Working		Answer	Mark	Notes
11	E.g. $\frac{10x}{6x} - \frac{3(x+2)}{6x}$ or $\frac{10x-3(x+2)}{6x}$			M1	for two correct fractions with common denominator or a single correct fraction
	$\frac{10x-3x-6}{6x}$ or $\frac{7}{6x} - \frac{1}{x}$			M1	for a correct single fraction with brackets expanded
			$\frac{7x-6}{6x}$	A1	for $\frac{7x-6}{6x}$ as the final answer
					SC: If no marks awarded then award B1 for an answer of $\frac{7x+6}{6x}$

Question	Working	Answer	Mark	Notes
12 (a)	$3 \times \frac{1}{3}x^2 - 9$			M1 for $3 \times \frac{1}{3}x^2$ oe or -9 oe
(b)		$x^2 - 9$ oe	2	A1 or for $1x^2 - 9$ oe
		$-3 < x < 3$ oe	3	B3 may be seen as two separate inequalities if not B3 then award B2 for $x < 3$ or $x > -3$ or $-3 \leq x \leq 3$ if not B2 then award B1 for $x^2 - 9 < 0$ or $x^2 < 9$ oe or for $(x-3)(x+3)$ or for $(x \pm) \pm 3$ (values maybe seen in incorrect inequalities) SC: If no marks awarded and M1 awarded in (a) then award B1 for “quadratic” < 0

Question	Working	Answer	Mark	Notes
13 (a)				M2 for at least 4 correct entries If not M2 then M1 for 2 or 3 correct entries NB: For the award of the method marks do not accept a blank outside the circles as 0
(b)		Correct Venn diagram	3	A1 Accept omission of 0 for the award of full marks M1 ft from Venn diagram for $\frac{a}{18}$ where a is an integer and $1 \leq a < 18$ or for $\frac{3}{b}$ where b is an integer and $b > 3$
		$\frac{3}{18}$ oe	2	A1 ft from Venn diagram

Question	Working	Answer	Mark	Notes
14 (a)	$T = kr^3$ $21.76 = k \times 4^3$ oe or $k = 0.34$			M1 Allow $r^3 = mT$ Do not allow $T = r^3$ M1 for correct substitution into a correct equation; implies first M1 Award M2 if $k = 0.34$ stated unambiguously ($m = 2.94$) Condone use of proportional sign in place of equals sign
(b)		$T = 0.34r^3$ oe 73.44	3 1	A1 Only award if T is the subject Award M2A1 if $T = kr^3$ on answer line and k given as 0.34 oe in working space. B1 ft for their value of k if $T = kr^3$

Question	Working	Answer	Mark	Notes
15	$\frac{4\pi r^2}{2} (+\pi r^2) = 2\pi(2r)h \text{ oe}$ $h = \frac{3}{4}r \text{ or } r = \frac{4}{3}h$ $\text{Eg } \frac{1}{2} \times \frac{4}{3} \times \pi \times r^3 \quad \text{and} \quad \pi \times (2r)^2 \times \frac{3}{4}r$ OR $\frac{1}{2} \times \frac{4}{3} \times \pi \times \left(\frac{4}{3}h \right)^3 \quad \text{and} \quad \pi \times \left(2 \times \frac{4}{3}h \right)^2 \times h$	4.5 oe	4	M1 for use of, for example, r and $2r$ in an equation condone omission of flat surface area A1 for a correct expression for either r or h M1 dep on award of first M1 ft for candidate's expression for r or h for correct expressions for volume of hemisphere and volume of cylinder ; both in terms of either r or h A1

Question	Working	Answer	Mark	Notes
16 (a)	$\text{Eg } \frac{a + \sqrt{4b}}{a - \sqrt{4b}} \times \frac{a + \sqrt{4b}}{a + \sqrt{4b}} \times \frac{a + 2\sqrt{b}}{a - 2\sqrt{b}} \times \frac{a + 2\sqrt{b}}{a + 2\sqrt{b}} \text{ or } \frac{(a + 2\sqrt{b})^2}{(a + 2\sqrt{b})(a - 2\sqrt{b})}$			M1 For multiplying the numerator and denominator by $a + \sqrt{4b}$ or $a + 2\sqrt{b}$
	$\text{Eg } \frac{(a + \sqrt{4b})(a + \sqrt{4b})}{a^2 - 4b}$			M1 dep on M1 for correctly simplified denominator
		$\frac{a^2 + 4a\sqrt{b} + 4b}{a^2 - 4b}$	3	A1 for $\frac{a^2 + 4a\sqrt{b} + 4b}{a^2 - 4b}$ or $\frac{(a + 2\sqrt{b})^2}{a^2 - 4b}$
(b)		2.5 oe	1	B1

Question	Working	Answer	Mark	Notes
17	$(AC^2 =) 4.1^2 + 5.3^2 - 2 \times 4.1 \times 5.3 \times \cos(110)$ $(AC =) \sqrt{16.81 + 28.09 + 14.8(641\dots)}$ or $\sqrt{59.7(641\dots)}$ or $7.7(3073)$ or $AC^2 = 59.7\dots$ Eg $\frac{\sin x}{5.3} = \frac{\sin 110}{7.7}$ or $\frac{5.3}{\sin x} = \frac{7.7}{\sin 110}$ or $5.3^2 = 4.1^2 + 7.7^2 - 2 \times 4.1 \times 7.7 \times \cos x$ or Eg $\sin x = \frac{\sin 110}{7.7} \times 5.3 (= 0.644(2\dots))$ or $\cos x = \frac{4.1^2 + 7.7^2 - 5.3^2}{2 \times 4.1 \times 7.7}$ ($= 0.764(83\dots)$)	40.1	5	M1 for the correct use of Cosine rule to find AC M1 NB: there must be evidence of correct order of operations for this mark to be awarded M1 dep on first M1 for correct use of sine rule or cosine rule ft for their value of AC or AC^2 M1 for isolating $\sin x$ or $\cos x$ A1 for 40.1 – 40.11

Question	Working	Answer	Mark	Notes
18 (a)		Parabola through $(-4, 5), (-2, 0), (0, -3), (2, -4), (4, -3), (6, 0), (8, 5)$		B2 For a parabola with minimum $(2, -4)$ through at least 5 of $(-4, 5), (-2, 0), (0, -3), (4, -3), (6, 0), (8, 5)$ If not B2 then B1 For u-shaped parabola with minimum $(2, -4)$ or For u-shaped parabola through $(-2, 0), (6, 0)$ or For u-shaped parabola through $(-4, 5), (8, 5)$
(b)		3	2 1	B1

Question	Working	Answer	Mark	Notes
19 (a)		$y \geq -3$	1	B1 Accept $g^{-1}(x) \geq -3$
(b)	$(x+3)^2 - 3^2$ or $(x+3)^2 - 9$ or $(y+3)^2 - 3^2$ or $(y+3)^2 - 9$ $y+9 = (x+3)^2$ or $x+9 = (y+3)^2$ $\sqrt{y+9} = x+3$ or $\sqrt{x+9} = y+3$		M1 M1 M1	for completing the square
		$-3 + \sqrt{x+9}$	4	A1 oe M3A0 for $-3 + \sqrt{y+9}$ and for $-3 \pm \sqrt{x+9}$

Question	Working	Answer	Mark	Notes
20	$\frac{n-4}{n} \text{ or } \frac{n-5}{n-1}$ $\frac{n-4}{n} \times \frac{n-5}{n-1} = \frac{1}{3}$ Eg $3(n^2 - 9n + 20) = n(n-1)$ or $3n^2 - 27n + 60 = n^2 - n$ Eg $2n^2 - 26n + 60 = 0$ or $n^2 - 13n + 30 = 0$ $\text{Eg } (n-10)(n-3) = 0 \text{ or } \frac{- -13 \pm \sqrt{(-13)^2 - 4 \times 1 \times 30}}{2 \times 1}$	10	6	M1 $\frac{n-4}{n}$ or $\frac{n-5}{n-1}$ M1 for the correct equation M1 for a correct quadratic equation with fractions removed M1 for a correct quadratic equation equal to 0 M1 dep on M2 ft for method to solve 3 term quadratic A1 for correct answer from correct working NB. Award M5A1 for an answer of 10 with justification e.g. $\frac{6}{10} \times \frac{5}{9} = \frac{1}{3}$ Award M0A0 for an answer of 10 with no working and no justification

Question	Working	Answer	Mark	Notes
21	Mark scheme 1 (see next page for alternative mark scheme) $(8x + 2) - (2x + 23) (= 6x - 21)$ or $(2x + 23) - (8x + 2) (= -6x + 21)$ or $(20x - 52) - (8x + 2) (= 12x - 54)$ or $(8x + 2) - (20x - 52) (= -12x + 54)$ $(8x + 2) - (2x + 23) = (20x - 52) - (8x + 2)$ oe or $(2x + 23) - (8x + 2) = (8x + 2) - (20x - 52)$ oe $x = 5.5$ Eg $2 \times 5.5 + 23 (=34)$ and $8 \times 5.5 + 2 (=46)$ OR $8 \times 5.5 + 2 (=46)$ and $20 \times 5.5 - 52 (=58)$	shown	4	M1 for a correct expression for the common difference in terms of x brackets must be present or removed correctly M1 for a correct equation A1 A1 for 12 from correct working

Question	Working	Answer	Mark	Notes
21	Alternative method – starts by assuming $d = 12$ E.g. $(2x + 23) + 12 = (8x + 2)$ or $(8x + 2) + 12 = (20x - 52)$ or $(2x + 23) - 12 = (8x + 2)$ or $(8x + 2) - 12 = (20x - 52)$ or $(2x + 23) + (8x + 2) + (20x - 52) = \frac{3}{2}(2(2x + 23) + 2 \times 12)$ $x = 5.5$ or $x = 1.5$ from $(2x + 23) - 12 = (8x + 2)$ or $x = 3.5$ from $(8x + 2) - 12 = (20x - 52)$ $2 \times 5.5 + 23 (=34)$ and $8 \times 5.5 + 2 (=46)$ and $20 \times 5.5 - 52 (=58)$ OR $2x + 23) + 12 = (8x + 2)$ and $(8x + 2) + 12 = (20x - 52)$ and gets $x = 5.5$ both times	shown	4	M2 for a correct equation If not M2 then award M1 for a correct expression for the common difference in terms of x brackets must be present or removed correctly e.g. $(8x + 2) - (2x + 23)$ ($= 6x - 21$) or $(20x - 52) - (8x + 2)$ ($= 12x - 54$) A1 A1 for explicitly showing both common differences are 12 OR solves both $(2x + 23) + 12 = (8x + 2)$ and $(8x + 2) + 12 = (20x - 52)$ and gets $x = 5.5$ both times