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** 2*p*(a two term expression) **or** *x*(2 + 3*q*) 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** $\ldots-2e-15$
		$e^2-2e-15$	2	A1
(c)	$5y=2y+1$ **or** $y=\frac{2y}{5}+\frac{1}{5}$			M1 for a correct first step
	E.g. $5y-2y=1$ **or** $3y=1$ **or** $3y-1=0$ **or** $\frac{3y}{5}=\frac{1}{5}$			M1 for collecting terms in *y* in a correct equation
		$\frac{1}{3}$ oe	3	A1 dep on at least M1 for $\frac{1}{3}$ oe **e**.g. $0.\dot{3}$, 0.3333…

Question	Working	Answer	Mark	Notes
2 (a)		Rotation, 90° clockwise, centre $(-2, 3)$	3	B1 for rotation B1 90° clockwise or -90^o (or 270^o 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
(b)		Triangle at (−2, 2), (−2, 4), (−1, 4)	1	B1 cao
(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)			M1 can be implied by two values where P(brown) + P(yellow) = 0.26 (may be seen in table)
	$(\text{P(yellow)}=)\dfrac{"0.26"-0.06}{2}$ **or** 0.1			M1 for a complete method to find P(yellow)
	$150\times"0.1"$			M1 independent mark Award for $150 \times p$ where $0 < p < 1$
		15	4	A1 NB: An answer of $\dfrac{15}{150}$ scores M3 A0

Question	Working	Answer	Mark	Notes
4 (a)	$1236.5 - 1126.5$ **or** 110 **or** $\frac{1236.5}{1126.5}$ **or** $1.09(7647...)$ **or** $\frac{1236.5}{1126.5}\times 100$ **or** $109(.7647...)$			M1
	$\frac{1236.5-1126.5}{1126.5}$ **or** $\frac{"110"}{1126.5}$ **or** $\left(\frac{1236.5}{1126.5}-1\right)$ **or** $\left(1.09(764...)-1\right)$ **or** $\frac{1236.5}{1126.5}\times 100-100$ **or** $0.0976(475...)$			M1 for method that would result in 9.76… or 0.0976…
		9.76	3	A1 for 9.76 - 9.765
(b)	1126.5×1.19 oe			M2 if not M2 then award M1 for $\frac{19}{100}\times 1126.5$ oe **or** 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 A1 dep on previous M1
	E.g. $20 \times$ "5" + 45 (=145) **or** $4 \times$ "5" + 15 (=35) **or** $30 \times$ "5" – 5 (=145) **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 **OR** forms a second equation in x
	E.g. $AFC = 145$ **and** $FCD = 145$ **OR** $AFC = 145$ **and** $BCF = 35$ **OR** $x = 5$ from the solution of **two** equations			A1 dep on previous M1 NB : It must be clear which angles are being found
		Shown correctly with reasons	5	B1 For full reasons: Alternate angles are equal **and** angles in a straight line add to 180^o **OR** Allied angles (or co-interior) add to 180^o **and** angles in a straight line add to 180^o

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)
			Correct curve	2	A1	for a correct curve
	(c)	$x^2-5x+6=x-1$			M1	or for $y=x-1$
					M1	for $y=x-1$ drawn
			1.6 and 4.4	3	A1	dep on M2 ft from their graph in (b) if at least 1 mark scored in (b)
7	(a)		71 800 000	1	B1	
	(b)	Eg $1.88\times10^7+3.10\times10^8+2.64\times10^8+7.18\times10^7$ **or** 18 800 000 + 310 000 000 + 264 000 000 + 71 800 000 with at least 3 numbers correct			M1	for a complete method **or** for digits 6646
			6.646×10^8 oe	2	A1	for 6.646×10^8 oe eg 664 600 000
	(c)		9.88×10^6	1	B1	

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

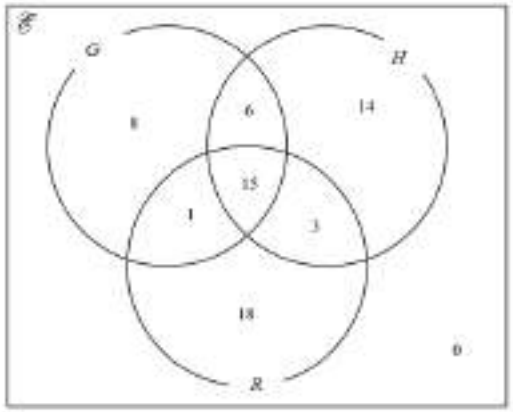
Question	Working	Answer	Mark	Notes
9 (a)		3, 19, 43, 53, 58, 60	1	B1
(b)			M1	ft from (a) if only one addition error for at least 4 points plotted correctly at end of interval **or** for all 6 points plotted consistently within each interval in the frequency table at the correct height (Eg. using values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

Question	Working	Answer	Mark	Notes
	Working with *CD* and then triangle *ABD*			
10	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* =) 13tan20 **or** 4.7(316...)			M1 for a correct method to find *CD* E.g. $\sqrt{\left(\frac{13}{\cos 20}\right)^2 - 13^2}$
	E.g. tan(*BAD*) = $\frac{8 + "4.73"}{13}$ **or** tan(*BAD*) = 0.97(93...)			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...)			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. $\cos 20 = \frac{13}{AC}$			M1 for a correct statement or equation including *AC* as the only variable E.g. $AC^2 = 13^2 + (13\tan 20)^2$
	E.g. $(AC =) \frac{13}{\cos 20}$ **or** $13.8(3\ldots)$			M1 for a correct method to find *AC* E.g. $\sqrt{13^2 + (13\tan 20)^2}$
	E.g. $(AB =) \sqrt{"13.8"^2 + 8^2 - 2\times 13.8\times 8\times \cos(110)}$ (=18.1(9..) **or** 18.2			M1 for a correct method to find *AB*
	E.g. $\frac{\sin BAC}{8} = \frac{\sin 110}{"18.1"}$ **or** $8^2 =$ "13.8"^{2} + "18.1"^{2} – 2 × "13.8"×"18.1"×cos *BAC*			M1 for a correct statement or equation including angle *BAC* as the only variable
		24.4	5	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
		$\frac{7x-6}{6x}$	3	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
		x^2-9 oe	2	A1 or for $1x^2-9$ oe
(b)		$-3<x<3$ oe	3	B3 may be seen as two separate inequalities if not B3 then award B2 for $x<3$ **or** $x>-3$ **or** $-3\le x\le 3$ if not B2 then award B1 for $x^2-9<0$ **or** $x^2<9$ oe **or** for $(x-3)(x+3)$ **or** for $(x=)\pm 3$ (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)		Correct Venn diagram	3	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 A1 Accept omission of 0 for the award of full marks
(b)		$\frac{3}{18}$ oe	2	M1 ft from Venn diagram for $\frac{a}{"18"}$ where a is an integer and $1 \le a < "18"$ or for $\frac{"3"}{b}$ where b is an integer and $b > "3"$ A1 ft from Venn diagram

Question	Working	Answer	Mark	Notes
14 (a)	$T = kr^3$			M1 Allow $r^3 = mT$ Do not allow $T = r^3$
	$21.76 = k \times 4^3$ oe **or** $k = 0.34$			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
		$T = 0.34r^3$ oe	3	A1 Only award if T is the subject Award M2A1 if $T = kr^3$ on answer line and k given as 0.34oe in working space.
(b)		73.44	1	B1ft for their value of k if $T = kr^3$

Question	Working	Answer	Mark	Notes	
15	Eg $\frac{4\pi r^2}{2}\left(+\pi r^2\right) = 2\pi(2r)h$ oe			M1	for use of, for example, r and $2r$ in an equation condone omission of flat surface area
	$h=\frac{3}{4}r$ **or** $r=\frac{4}{3}h$			A1	for a correct expression for either r or h
	Eg $\frac{1}{2}\times\frac{4}{3}\times\pi\times r^3$ **and** $\pi\times(2r)^2\times"\frac{3}{4}r"$ **OR** $\frac{1}{2}\times\frac{4}{3}\times\pi\times\left("\frac{4}{3}h"\right)^3$ **and** $\pi\times(2\times"\frac{4}{3}h")^2\times h$			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
		4.5 oe	4	A1	

Question	Working	Answer	Mark	Notes
16 (a)	Eg $\frac{a+\sqrt{4b}}{a-\sqrt{4b}}\times\frac{a+\sqrt{4b}}{a+\sqrt{4b}}$ **or** $\frac{a+2\sqrt{b}}{a-2\sqrt{b}}\times\frac{a+2\sqrt{b}}{a+2\sqrt{b}}$ **or** $\frac{\left(a+2\sqrt{b}\right)^2}{\left(a+2\sqrt{b}\right)\left(a-2\sqrt{b}\right)}$			M1 For multiplying the numerator and denominator by $a+\sqrt{4b}$ or $a+2\sqrt{b}$
	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** $\frac{\left(a+2\sqrt{b}\right)^2}{a^2-4b}$
(b)		2.5 oe	1	B1

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

Question	Working	Answer	Mark	Notes
18 (a)		Parabola through $(-4,5),(-2,0),(0,-3),(2,-4),(4,-3)(6,0),(8,5)$	2	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	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** $(y+3)^2 - 9$			M1	for completing the square
		$y+9 = (x+3)^2$ **or** $x+9 = (y+3)^2$			M1	
		$\sqrt{y+9} = x+3$ **or** $\sqrt{x+9} = y+3$			M1	
			$-3+\sqrt{x+9}$	4	A1	oe M3A0 for $-3+\sqrt{y+9}$ and for $-3\pm\sqrt{x+9}$

Question	Working	Answer	Mark	Notes
20	$\frac{n-4}{n}$ or $\frac{n-5}{n-1}$			M1 $\frac{n-4}{n}$ or $\frac{n-5}{n-1}$
	$\frac{n-4}{n}\times\frac{n-5}{n-1}=\frac{1}{3}$			M1 for the correct equation
	Eg $3(n^2-9n+20)=n(n-1)$ **or** $3n^2-27n+60=n^2-n$			M1 for a correct quadratic equation with fractions removed
	Eg $2n^2-26n+60=0$ **or** $n^2-13n+30=0$			M1 for a correct quadratic equation equal to 0
	Eg $(n-10)(n-3)=0$ **or** $\frac{--13\pm\sqrt{(-13)^2-4\times1\times30}}{2\times1}$			M1 dep on M2 ft for method to solve 3 term quadratic
		10	6	A1 for correct answer from correct working NB. Award M5A1 for an 8answer 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 justificastion

Question	Working	Answer	Mark	Notes
	Mark scheme 1 (see next page for alternative mark scheme)			
21	$(8x + 2) – (2x + 23)$ $(= 6x – 21)$ **or** $(2x + 23) – (8x + 2)$ $(= −6x + 21)$ **or** $(20x – 52) – (8x + 2)$ $(= 12x – 54)$ **or** $(8x + 2) – (20x – 52)$ $(= −12x + 54)$			M1 for a correct expression for the common difference in terms of x brackets must be present or removed correctly
	$(8x + 2) – (2x + 23) = (20x – 52) – (8x + 2)$ oe **or** $(2x + 23) – (8x + 2) = (8x + 2) – (20x – 52)$ oe			M1 for a correct equation
	$x = 5.5$			A1
	Eg $2 × 5.5 + 23$ $(=34)$ **and** $8 × 5.5 + 2$ $(=46)$ **OR** $8 × 5.5 + 2$ $(=46)$ **and** $20 × 5.5 − 52$ $(=58)$	shown	4	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** $(2x + 23) + (8x + 2) + (20x – 52) = \frac{3}{2}\left(2(2x + 23) + 2 \times 12\right)$ $x = 5.5$ **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