Pearson

Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE In Mathematics A
4WM1H/01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)

- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - awrt – answer which rounds to
  - eeoo – each error or omission

- **No working**

  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.
  If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for

the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

International GCSE Maths				
Values in quotation marks must come from a correct method previously seen unless clearly stated otherwise.				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	$\frac{2\times\pi\times6}{2}\left(=6\pi=18.8...=\frac{132}{7}\right)$ oe or $\frac{\pi\times12}{2}\left(=6\pi=18.8...=\frac{132}{7}\right)$ oe or $\pi\times6\left(=6\pi=18.8...=\frac{132}{7}\right)$ oe or $\frac{216}{7}$		2	M1 A correct method to find the perimeter of the curved part of the semicircle Allow 3.14… or $\frac{22}{7}$ for π
	Correct answer scores full marks (unless from obvious incorrect working)	30.8		A1 30.8 – 30.9
				Total 2 marks

2	Any **two** from: 2 (or 4) **or** 60 **or** 9 (or 3)		2	M1 For rounding at least 2 of the 3 given numbers to one significant figure
	eg $\frac{2^2\times60}{\sqrt{9}}=80$ or $\frac{4\times60}{3}=80$	80 with rounded calculation seen		A1 dep on M1, all figures rounded correctly and 80 given. Ignore any statements – just mark the rounded calculation
	Working required			
				Total 2 marks

3	$\frac{26}{7}(+)\frac{5}{3}$ **or** $(3)\frac{15}{21}(+)(1)\frac{14}{21}$ oe **or** $(3)\frac{15a}{21a}(+)(1)\frac{14a}{21a}$ oe		3	M1	for correct improper fractions **or** fractional part of numbers written correctly over a suitable common denominator
	eg $\frac{78}{21}+\frac{35}{21}$ **or** $\frac{26\times3}{3\times7}+\frac{5\times7}{3\times7}$ **or** $\frac{26\times3+5\times7}{3\times7}$ **or** $\frac{78a}{21a}+\frac{35a}{21a}$ **or** $3\frac{15}{21}+1\frac{14}{21}=4\frac{29}{21}$ oe **or** $4+\frac{15}{21}+\frac{14}{21}=4+1\frac{8}{21}$ oe			M1	for correct fractions with a common denominator with addition sign present **or** for working with mixed numbers to the stage shown implies the first M1
	eg $\frac{78}{21}+\frac{35}{21}=\frac{113}{21}=5\frac{8}{21}$ **or** $3\frac{15}{21}+1\frac{14}{21}=4\frac{29}{21}=5\frac{8}{21}$ If common denominator is not 21 then cancelling must be shown eg $\frac{156}{42}+\frac{70}{42}=\frac{226}{42}=\frac{113}{21}=5\frac{8}{21}$ oe **or** $\frac{156}{42}+\frac{70}{42}=\frac{226}{42}=5\frac{16}{42}=5\frac{8}{21}$ oe **or** $3\frac{30}{42}+1\frac{28}{42}=4\frac{58}{42}=4\frac{29}{21}=5\frac{8}{21}$ oe	A fully correct solution shown		A1	Dep on M2 for a correct answer from fully correct working If a student shows that $5\frac{8}{21}=\frac{113}{21}$ and has working that shows LHS $=\frac{113}{21}$ this can gain full marks NB Use of decimals scores no marks unless as a check
	Working required				
					Total 3 marks

4	(a)		9, 11, 13, 15, 17	1	B1	All numbers must be present (in any order) with no repeats or extras. Allow (set) *A*
	(b)		8, 10, 11, 12, 13, 14, 16, 17, 18	1	B1	(NB: this is all values apart from 9 and 15). All numbers must be present (in any order) with no repeats.
	(c)	No − 15 is not a prime number No − set is empty No − no numbers/values in the set No – there is nothing in common No – 15 is not in C No – no prime numbers in the universal set are multiples of 3	No and correct reason	1	B1	"No" box must be indicated **and** an acceptable reason given.
	(d)		9, 15	1	B1	Both values in either order not repeated
						Total 4 marks

5	(a)		0.55	1	B1	or 55% or $\frac{55}{100}$ or $\frac{11}{20}$ oe or $\frac{0.55}{1}$ If probabilities are given as percentages, then % sign must be seen
	(b)	eg 1 – "0.55" (= 0.45) **or** 1 – (0.2 + 0.35) (= 0.45) **or** $2x+0.2+x+0.35=1$ oe **or** $3x+"0.55"=1$ oe **or** 0.2 × 700 (= 140) **or** 0.35 × 700 (= 245) **or** "0.55" × 700 (= 385)		4	M1	Showing understanding that probabilities total 1 If probabilities are given as percentages, then % sign must be seen or for the number of students who prefer tennis or cricket
		"0.45" ÷ 3 (= 0.15 = $\frac{3}{20}$) **or** "0.45" ÷ 3 × 2 (= 0.3 = $\frac{6}{20}=\frac{3}{10}$) **or** (x =) 0.15 or (x =) $\frac{3}{20}$ **or** ($2x$ =) 0.3 or $(2x=)\frac{3}{10}$ **or** "0.45" × 700 (= 315) **or** 700 – "140" – "245" (= 315) **or** 700 – "385" (= 315)			M1	for a method to find x or $2x$ or for the probability of rugby or football or for the number of students who do not prefer tennis or cricket
		(2 × "0.15") × 700 or "0.15" × 700 (= 105) or $\frac{2}{3}\times"315"$ oe or $\frac{1}{3}\times"315"(=105)$ oe			M1	or for $\frac{210}{700}$ or $\frac{105}{700}$
		Correct answer scores full marks (unless from obvious incorrect working)	210		A1	
						Total 5 marks

6	(a)		474.5	1	B1
	(b)		125	1	B1 allow $124.\dot{9}$ or 124.999(9…)
					Total 2 marks

7	eg $(8^{-2} \times 8^{9} =)\ 8^{-2+9}$ or 8^{7} or 2^{-6+27} or 2^{21} **or** $(8^{-2} \div 8^{10} =)\ 8^{-2-10}$ or 8^{-12} or $\frac{1}{8^{12}}$ or 2^{-6-30} or 2^{-36} or $\frac{1}{2^{36}}$ **or** $(8^{9} \div 8^{10} =)\ 8^{9-10}$ or 8^{-1} or $\frac{1}{8^{(1)}}$ or 2^{27-30} or 2^{-3} or $\frac{1}{2^{3}}$ **or** $(8^{n} \times 8^{10} =)\ 8^{n+10}$ or 2^{3n+30} **OR** $-2 + 9 = n + 10$ oe or $-6 + 27 = 3n + 30$ oe **OR** $-2 + 9 - 10$ oe or $\frac{-6+27-30}{3}$ oe		2	M1	for one correct application of an index rule (must be seen in powers of 8 or correct conversion to powers of 2) this could be after an initial mistake – working will need to be clearly seen **OR** for forming a correct equation in the indices alone **OR** for a complete method for the value of n
	Correct answer scores full marks (unless from obvious incorrect working)	–3		A1	Accept 8^{-3} or $\left(2^{3}\right)^{-3}$
					Total 2 marks

8	(a)		$15w^2 - 20w^3$	2	B2	(B1 for $15w^2$ or $-20w^3$)
	(b)		$64a^9c^{15}$	2	B2	for $64a^9c^{15}$ B1 for a product in the form ka^pc^q where 2 from k, p or q are correct eg $12a^9c^{15}$ (Allow $64a^9$ or $64c^{15}$ or $4a^9c^{15}$ as long as not added to any other terms)
	(c)		$7m^2p^2(2m+3p^2)$	2	B2	For $7m^2p^2(2m+3p^2)$ B1 for any **correct** partial factorisation with at least 2 different factors outside the bracket eg $mp(14m^2p + 21mp^3)$ or $m^2p(14mp + 21p^3)$ $mp^2(14m^2 + 21mp^2)$ or $m^2p^2(14m + 21p^2)$ $7p(2m^3p + 3m^2p^3)$ or $7p^2(2m^3 + 3m^2p^2)$ $7m(2m^2p^2 + 3mp^4)$ or $7m^2(2mp^2 + 3p^4)$ $7mp(2m^2p + 3mp^3)$ or $7m^2p(2mp + 3p^3)$ $7mp^2(2m^2 + 3mp^2)$ **or** for a correct factor with one error inside the bracket eg. $7m^2p^2$ $(\ldots + 3p^2)$ or $7m^2p^2(2m + \ldots)$ or for a correct factor eg $\ldots(2m + 3p^2)$
	(d)(i)	$(x \pm 6)(x \pm 4)$ or $(6 \pm x)$ $(4 \pm x)$ or $x(x - 6) - 4(x - 6)$ or $x(x - 4) - 6(x - 4)$		2	M1	for $(x \pm 6)(x \pm 4)$ or for brackets in the form $(x + a)(x + b)$ where $ab = 24$ or $a + b = -10$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x-6)(x-4)$		A1	oe Allow any letter for x
	(ii)		6, 4	1	B1	**Must** follow through from (d)(i) and must be 2 values – see additional sheet for rules ie if (d)(i) is incorrect this will follow from their incorrect answer.
						Total 9 marks

9	15 – 0 (= 15) **and** 10 – 2 (= 8)		4	M1	±15 **and** ±8 seen may be written on the diagram or in a gradient calculation
	$15^2 + (10-2)^2$ oe or $15^2 + 8^2$ oe			M1	Allow use of ±15 and ±8
	$\sqrt{15^2 + "8"^2}\ (=17)$ oe			M1	If negative values used then correct use of brackets (or recovery) for this mark
	Correct answer scores full marks ***(unless from obvious incorrect working)***	19, 0		A1	cao
					Total 4 marks

10	(area =) 7 × 7 or 7^2 or 49 oe		3	M1	for area of 1 face
	(F =) "49" × 62 oe or $62 = \frac{F}{"49"}$ oe			M1	dep on a correct method for area of 1 face for using $P = \frac{F}{A}$ correctly
	Correct answer scores full marks (unless from obvious incorrect working)	3038		A1	cao
					Total 3 marks

11	eg $\cos(ACB)=\frac{15}{21}$ **or** $\sin(ACB)=\frac{\sqrt{21^2-15^2}}{21}$ oe **or** 44.4(153…) **or** $\tan(DCB)=\frac{9}{15}$ **or** $\sin(DCB)=\frac{9}{\sqrt{9^2+15^2}}$ oe **or** 30.9(637…) **or** $\tan(BDC)=\frac{15}{9}$ **or** $\sin(BDC)=\frac{15}{\sqrt{9^2+15^2}}$ oe **or** 59.0(362…) **or** $\sin(BAC)=\frac{15}{21}$ **or** 45.5(846…) **OR** $(AB=)\ \sqrt{21^2-15^2}\ (=\sqrt{216}=6\sqrt{6}=14.6(969...))$ **or** $(DC=)\ \sqrt{15^2+9^2}\ (=\sqrt{306}=3\sqrt{34}=17.4(928...))$		4	M1	for a correct trig statement for angle *ACB* **or** angle *DCB* **or** angle *BDC* **or** angle *BAC* **OR** for use of Pythagoras to find *AB* or *DC* Allow use of any letter to represent the angles or sides Calculations or values do not need to be linked to the correct side or angle
	eg $\cos(ACB)=\frac{15}{21}$ **or** $\sin(ACB)=\frac{\sqrt{21^2-15^2}}{21}$ oe **or** 44.4(153…) **and** $\tan(DCB)=\frac{9}{15}$ **or** $\sin(DCB)=\frac{9}{\sqrt{9^2+15^2}}$ oe **or** 30.9(637…) **OR** $\frac{\sin ACD}{"14.6..."-9}=\frac{\sin(180-"59.0")}{21}$ oe or $\frac{\sin ACD}{"14.6..."-9}=\frac{\sin"45.5(846...)}{"17.4(928...)"}$ oe **or** $("14.6..."-9)^2=21^2+"17.4"^2-2\times21\times"17.4"\times\cos ACD$ oe			M1	for a correct trig statement for angle *ACB* **and** angle *DCB* or angle *BAC* **and** angle *DCB* or angle *BAC* **and** angle *ADC* **OR** for a correct trig statement involving angle *ACD* Allow use of any letter to represent the angles or sides Calculations or values do not need to be linked to the correct side or angle
	eg "44.4(153…)" – "30.9(637…)" **OR** $\sin(ACD)=\frac{\sin(180-"59.0")}{21}\times("14.6..."-9)\ (=0.232...)$ oe **or** $\cos(ACD)=\frac{21^2+"17.4"^2-("14.6..."-9)^2}{2\times21\times"17.4"}\ (=0.972...)$ oe			M1	for a complete method **OR** for a correct trig statement for angle *ACD* Allow use of any letter to represent the angle
	Correct answer scores full marks (unless from obvious incorrect working)	13.5		A1	Answer in range 13.4 – 13.6
					Total 4 marks

12 (a)			2	B1	for $\frac{3}{5}$ on bottom left oe (0.6)
				B1	for $\frac{3}{8},\frac{5}{8},\frac{3}{8},\frac{5}{8}$ oe (0.375, 0.625, 0.375, 0.625)
(b)	$\frac{2}{5}\times"\frac{3}{8}"\left(=\frac{6}{40}\right)$oe **or** $\frac{2}{5}\times"\frac{5}{8}"\left(=\frac{10}{40}\right)$oe **or** $"\frac{3}{5}"\times"\frac{3}{8}"\left(=\frac{9}{40}\right)$oe **or** $"\frac{3}{5}"\times"\frac{5}{8}"\left(=\frac{15}{40}\right)$oe		3	M1	ft their tree diagram if probabilities less than 1 Allow equivalent fractions or decimals ie 0.4 or 0.37(5)
	$1-\frac{2}{5}\times"\frac{3}{8}"$ oe **or** $\frac{2}{5}\times"\frac{5}{8}"+"\frac{3}{5}"\times"\frac{3}{8}"+"\frac{3}{5}"\times"\frac{5}{8}"$ oe **or** $\frac{2}{5}\times"\frac{5}{8}"+"\frac{3}{5}"$			M1	ft a correct calculation for the required probability Allow equivalent fractions or decimals ie 0.4 or 0.37(5)
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{17}{20}$		A1 **ft**	oe eg $\frac{34}{40}$ **or** 0.85 **or** 85% Allow equivalent fractions or decimals to 2dp truncated or rounded or equivalent percentage (with % sign) to 2sf truncated or rounded
					Total 5 marks

13 (a)	eg $7x(3x+2)=21x^2+14x$ **or** $7x(2x-5)=14x^2-35x$ **or** $(3x+2)(2x-5)=6x^2-15x+4x-10$ $(=6x^2-11x-10)$		3	M1	an expansion with only one error. Do not award this mark for $21x^2+14x+14x^2-35x$ **or** $\left(21x^2+14x\right)\left(14x^2-35x\right)$	M2 for 3 (out of a maximum of 4) of $42x^3-105x^2+28x^2-70x$
	eg $42x^3-105x^2+28x^2-70x$ **or** $42x^3-77x^2-70x$			M1	ft dep on M1 and a quadratic expression allow one further error	(M1 for 2 correct out of a maximum of 4)
	Correct answer scores full marks (unless from obvious incorrect working)	$42x^3-77x^2-70x$		A1	if no working shown then award B2 for 2 terms out of a maximum of 3 terms correct isw correct factorisation eg $7(6x^3-11x^2-10x)$ provided 3 marks has been awarded do not isw incorrect simplification eg $42x^3-77x^2-70x=6x^3-11x^2-10x$ gets M2A0	
(b)	eg $\frac{9\times7}{7\times2y}+\frac{5\times2y}{7\times2y}(=5)$ oe or $\frac{63}{14y}+\frac{10y}{14y}(=5)$ oe **or** $\frac{63+10y}{14y}(=5)$ oe **or** $\frac{9}{2y}=5-\frac{5}{7}$ **or** $\frac{9}{2y}=4\frac{2}{7}\left(=\frac{30}{7}\right)$ **or** $9+\frac{10y}{7}=10y$ **or** $\frac{63}{2y}+5=35$		3	M1	for writing LHS correctly over the same common denominator **or** for subtracting $\frac{5}{7}$ from both sides allow use of equivalent decimal 0.71(42…) for method marks **or** multiplying through by $2y$ **or** multiplying through by 7	
	eg $63+10y=70y$ oe **or** $63=60y$ oe **or** $\frac{63}{2}=30y$ **or** $2.1=2y$ **or** $2y=\frac{9}{30/7}$ oe			M1	for a correct equation with all fractions removed **or** for a correct equation with y isolated	
	Working required	1.05		A1	oe eg $\frac{63}{60}$ or $\frac{21}{20}$ dep on M1	
						Total 6 marks

14	$\frac{75}{360}\times\pi\times12^2(=30\pi)$ oe		2	M1 a correct method to find the area of the sector Allow 3.14… or $\frac{22}{7}$ for π
	Correct answer scores full marks (unless from obvious incorrect working)	94.2		A1 accept 94.2 – 94.3
				Total 2 marks

15	2 of: 2^4 , $(2^4)^{x-3}$ oe or 2^3 , $(2^3)^{x+1}$ oe or 2^5 , $(2^5)^x$ oe		3	M1 For **powers of 2** with two of -16 as 2^4 or 16^{x-3} as $(2^4)^{x-3}$ oe - 8 as 2^3 or 8^{x+1} as $(2^3)^{x+1}$ oe -32 as 2^5 or 32^x as $(2^5)^x$ oe
	$4(x-3)+3(x+1)-5x$ or $7x-9-5x$ oe $(=n)$ oe **or** $2^{4(x-3)+3(x+1)-5x}$ or $2^{7x-9-5x}$ or 2^{2x-9} **or** eg $4(x-3)+3(x+1)$ oe or $7x-9$ oe **or** eg $2^{4(x-3)+3(x+1)}$ oe			M1 A correct method for *n* **or** for a correct expression for the numerator for a single power of 2 (allow an additional, incorrect term for the denominator) The award of this mark implies the first M1
	Correct answer scores full marks (unless from obvious incorrect working)	$2x-9$		A1 oe but must be simplified
				Total 3 marks

16	$\frac{2\sqrt{7}+2}{\sqrt{7}-3}\times\frac{\sqrt{7}+3}{\sqrt{7}+3}$ **or** $\frac{2\sqrt{7}+2}{\sqrt{7}-3}\times\frac{-\sqrt{7}-3}{-\sqrt{7}-3}$		3	M1	for explicitly multiplying the numerator and denominator by $\sqrt{7}+3$ or $-\sqrt{7}-3$
	$\frac{2\sqrt{7}\sqrt{7}+6\sqrt{7}+2\sqrt{7}+6}{\sqrt{7}\sqrt{7}+3\sqrt{7}-3\sqrt{7}-9}$ oe **or** $\frac{14+6\sqrt{7}+2\sqrt{7}+6}{7-9}$ oe **or** $\frac{20+8\sqrt{7}}{-2}$ **or** $\frac{20+\sqrt{448}}{-2}$ or $\frac{-2\sqrt{7}\sqrt{7}-6\sqrt{7}-2\sqrt{7}-6}{-\sqrt{7}\sqrt{7}-3\sqrt{7}+3\sqrt{7}+9}$ oe **or** $\frac{-14-6\sqrt{7}-2\sqrt{7}-6}{-7+9}$ **or** $\frac{-20-8\sqrt{7}}{2}$ **or** $\frac{-20-\sqrt{448}}{2}$			M1	numerator correctly expanded and may be simplified to at least 2 terms and denominator correctly expanded and may be simplified to one term, this mark implies previous M1 $\frac{2\sqrt{7}+2}{\sqrt{7}-3}\times\frac{\sqrt{7}+3}{\sqrt{7}+3}=-10-4\sqrt{7}$ scores M1M0
	Working required	$-10-\sqrt{112}$		A1	dep on M2 SCB1 for $-10-\sqrt{112}$ gained with no method marks awarded SCB2 for $-10-\sqrt{112}$ gained if you would award 1st M1 but not second M1 (total 2 marks)
					Total 3 marks

17	eg (1000x =) 954.54… (10x =) 9.54… OR eg (100 000x =) 954 54.54… (1000x =) 954.54… OR eg (100x =) 95.454…. (x =) 0.95454….		2	M1 M1 for two recurring decimals that when subtracted give a whole number or terminating decimal (945 or 94 500 or 94.5 etc) with the intention to subtract. eg (1000x =) 954.54…and (10x =) 9.54.... **or** (100 000x =) 954 54.… and (1000x =) 954.54 **or** (100x =) 95.454…. and (x =) 0.95454…. (if recurring dots are not shown in both numbers, then showing at least **one** of the numbers to at least 5sf) or $\frac{9}{10}$ + method for 0.05454… $\left(=\frac{3}{55}\right)$ (1000x (54.54…) − 10x (0.5454…) etc…)
	eg 1000x – 10x = 954.54.... – 9.54.... = 945 (990x = 945) **and** $\frac{945}{990}=\frac{21}{22}$ or eg 100 000x – 1000x = 95 454.… – 954.54… =94 500 (99 000x = 94 500) **and** $\frac{94\,500}{99\,000}=\frac{21}{22}$ or 100x – x = 95.454….– 0.954.,,, (99x = 94.5) **and** $\frac{94.5}{99}=\frac{21}{22}$ or $\frac{9}{10}+\frac{54}{990}=\frac{9\times99+54}{990}=\frac{21}{22}$	shown		A1 dep on M1 for completion to $\frac{21}{22}$ dep on M1 and must use algebra for this final mark to be awarded [allow for instance 99x = 94.5 and then $\frac{945}{990}=\frac{21}{22}$] **No algebra used gets a maximum of 1**
	Working required			**Total 2 marks**

18	(a)	$(8x+2)(3x-2)$ $24x^2-16x+6x-4=500$ or $24x^2-10x-4=500$ eg $24x^2-10x-504=0$ $12x^2-5x-252=0$	shown	1	B1	Need to see terms of the expansion, simplifying, division by 2 at any stage and rearranging to $12x^2-5x-252=0$ **Allow if part (a) is done in part (b) (if it is not done in (a))**
	(b)	$\frac{--5\pm\sqrt{(-5)^2-4\times12\times-252}}{2\times12}$ oe		3	M1	correct substitution into the formula or can be simplified as far as $\frac{5\pm\sqrt{12121}}{24}$ (allow + in place of ± in the formula) Condone 1 sign error in substitution. Condone omission of brackets. Allow partial correct evaluation.
		$\frac{5\pm\sqrt{12121}}{24}$ or 4.79(….) and − 4.37(…) or 4.8 and − 4.4			M1	Simplification to $\frac{5\pm\sqrt{12121}}{24}$ or evaluation of the positive and negative values. (allow + in place of ± in the formula)
		Correct answer scores full marks (unless from obvious incorrect working)	4.8		A1	dep on first M1 and no errors Allow 4.79… **Allow if part (b) is done in part (a) (if it is not done in (b))**
						Total 4 marks

19	$10^2 = 8^2 + 9^2 - 2\times 8\times 9\times \cos BAC$ oe		3	M1	correct statement of the cosine rule for this angle in any form
	$\cos BAC = \dfrac{8^2 + 9^2 - 10^2}{2\times 8\times 9}$ oe **or** $\cos BAC = \dfrac{45}{144}$ oe **or** $\cos BAC = \dfrac{5}{16}$ oe eg $\cos BAC = 0.31(25)$			M1	correct statement for angle *BAC*, this mark implies the previous M mark
	Correct answer scores full marks (unless from obvious incorrect working)	71.8		A1	accept 71.7 – 71.8 SCB1 for an answer of 49.4 to 49.5 **or** 58.7 to 58.8
					Total 3 marks

20	FD: 2.4, 3.4, 3, 1.4 Widths 5, 10, 15, 20 respectively		3	M1	For at least 2 correct frequency densities – implied by 2 correct bars for their **linear** scale
				M1	For 3 or 4 correct frequency densities **and** 2 correct bars drawn for their **linear** scale or 3 correct bars (this implies 3 correct FDs)
	Correct answer scores full marks (unless from obvious incorrect working)			A1	Correct histogram with frequency density axis numbered SCB2 for all four bars of correct width with heights in the correct ratio eg 24, 34, 30, 14 SCB1 for three bars of correct width with heights in the correct ratio
					Total 3 marks

21	eg (height =) $5r \times \sin 60$ or $\left(\sqrt{(5r)^2 - (2.5r)^2}\right)$ $\left(= \sqrt{18.74r^2} = 5\frac{\sqrt{3}}{2}r = 4.33(0...)r\right)$ eg (area=) $\frac{1}{2} \times 5r \times 5r \times \sin 60$ or $25\frac{\sqrt{3}}{4}r^2$ or $10.8(25...)r^2$ oe **or** $\frac{1}{2} \times 5r \times \left(\sqrt{(5r)^2 - (2.5r)^2}\right)$ or $\frac{1}{2} \times 5r \times \sqrt{18.74r^2}$ oe		4	M1 A correct method for the height or area of the triangle (in terms of the radius)
	eg $\frac{1}{2} \times 5r \times 5r \times \sin 60 - \pi r^2 = 610\pi$ oe **or** eg $\frac{1}{2} \times 5r \times \left(\sqrt{(5r)^2 - (2.5r)^2}\right) = 610\pi + \pi r^2$ oe **or** eg $25\frac{\sqrt{3}}{4}r^2 - \pi r^2 = 610\pi$ oe			M1 A correct equation with the shaded area (in terms of the radius) (allow misread of 610 instead of 610π)
	eg $r^2\left(\frac{1}{2} \times 5 \times \frac{5\sqrt{3}}{2} - \pi\right) = 610\pi$ oe eg $r^2\left(\frac{25\sqrt{3}}{4} - \pi\right) = 610\pi$ or $r^2\left(25\sqrt{3} - 4\pi\right) = 2440\pi$ **or** eg $r^2 = \frac{2440\pi}{25\sqrt{3} - 4\pi}$ $(= 249(.406...))$ oe eg $\frac{610\pi}{\frac{25\sqrt{3}}{4} - \pi}$			M1 Factorising with r^2 in a correct equation or a correct expression for r^2 (allow misread of 610 instead of 610π)
	Correct answer scores full marks (unless from obvious incorrect working)	15.8		A1 15.7 – 15.8
				Total 4 marks

22	$(3x \pm n)^2$ **or** $p^2x^2 - prx - prx + r^2$ or $p^2x^2 - 2prx + r^2$ **or** 2 of : $9 = p^2$, oe $-12 = -2pr$, oe $q = r^2$ oe **or** $9\left(x - \frac{2}{3}\right)^2 - 4 + q$ or $(3x-2)^2 - 4 + q$		2	M1	For attempting to factorise **or** For expanding $(px - r)^2$ correctly **or** for equating 2 or 3 coefficients from the expansion of $(px - r)^2$. **or** for completing the square of the quadratic and simplifying correctly.
	Correct answer scores full marks (unless from obvious incorrect working)	4		A1	
					Total 2 marks

23	$\frac{3}{15}\times\frac{2}{14}\times\frac{1}{13}\left(=\frac{6}{2730}=\frac{1}{455}\right)$ oe **or** $\left(\frac{3}{15}\times\frac{2}{14}\times\frac{10}{13}\right)\left(=\frac{60}{2730}=\frac{2}{91}\right)$ oe **or** $\left(\frac{3}{15}\times\frac{10}{14}\times\frac{9}{13}\right)\left(=\frac{270}{2730}=\frac{9}{91}\right)$ oe **or** $\left(\frac{3}{15}\times\frac{2}{14}\times\frac{2}{13}\right)\left(=\frac{12}{2730}=\frac{2}{455}\right)$ oe **or** $\left(\frac{10}{15}\times\frac{9}{14}\times\frac{8}{13}\right)\left(=\frac{720}{2730}=\frac{24}{91}\right)$ oe **or** $\left(\frac{10}{15}\times\frac{9}{14}\times\frac{2}{13}\right)\left(=\frac{180}{2730}=\frac{6}{91}\right)$ oe **or** $\left(\frac{10}{15}\times\frac{3}{14}\times\frac{2}{13}\right)\left(=\frac{60}{2730}=\frac{2}{91}\right)$ oe **OR** $\left(\frac{2}{15}\times\frac{1}{14}\times\frac{3}{13}\right)\left(=\frac{6}{2730}=\frac{1}{455}\right)$ oe **or** $\left(\frac{2}{15}\times\frac{1}{14}\times\frac{10}{13}\right)\left(=\frac{20}{2730}=\frac{2}{273}\right)$ oe **or** $\left(\frac{2}{15}\times\frac{1}{14}\times\frac{13}{13}\right)\left(=\frac{26}{2730}=\frac{1}{105}\right)$ oe **OR** $\left(\frac{13}{15}\times\frac{12}{14}\times\frac{11}{13}\right)\left(=\frac{1716}{2730}=\frac{22}{35}\right)$ oe **or** $\left(\frac{13}{15}\times\frac{12}{14}\times\frac{2}{13}\right)\left(=\frac{312}{2730}=\frac{4}{35}\right)$ oe		3	M1	one of **numerical** probabilities for RRR **or** RRB **or** RBB **or** RRP **or** BBB **or** BBP **or** BRP **OR** PPR **or** PPB **or** PPP′ **OR** P′ P′ P′ **or** P′ P′P [where P = probability of pink, R = probability of red, B = probability of blue, P′ = probability of not pink] For $\left(\frac{2}{15}\times\frac{1}{14}\times\frac{13}{13}\right)\left(=\frac{26}{2730}=\frac{1}{105}\right)$ accept $\left(\frac{2}{15}\times\frac{1}{14}\right)\left(=\frac{1}{105}\right)$
	$\left(\frac{3}{15}\times\frac{2}{14}\times\frac{1}{13}\right)+3\left(\frac{3}{15}\times\frac{2}{14}\times\frac{10}{13}\right)+3\left(\frac{3}{15}\times\frac{10}{14}\times\frac{9}{13}\right)+3\left(\frac{3}{15}\times\frac{2}{14}\times\frac{2}{13}\right)+\left(\frac{10}{15}\times\frac{9}{14}\times\frac{8}{13}\right)+3\left(\frac{10}{15}\times\frac{9}{14}\times\frac{2}{13}\right)+6\left(\frac{10}{15}\times\frac{3}{14}\times\frac{2}{13}\right)$ **OR** $1-3\times\left(\frac{2}{15}\times\frac{1}{14}\times\frac{3}{13}\right)-3\times\left(\frac{2}{15}\times\frac{1}{14}\times\frac{10}{13}\right)$ **OR** $1-3\times\frac{2}{15}\times\frac{1}{14}\times\frac{13}{13}$ oe **OR** $\left(\frac{13}{15}\times\frac{12}{14}\times\frac{11}{13}\right)+3\left(\frac{13}{15}\times\frac{12}{14}\times\frac{2}{13}\right)$			M1	for adding at least one of each probability for RRR, RRB, RBB, RRP, BBB, BBP and BRP **OR** for subtracting at least one of the probabilities of PPR and PPB from 1 **OR** subtracting at least one of the probabilities for PPP′ from 1 **OR** for adding 3PPR and 3PPB **OR** for 3 PPP′ **OR** for adding at least one of the probabilities for P′ P′ P′ and P′ P′P for $\frac{2}{15}\times\frac{1}{14}\times\frac{13}{13}$ accept $\frac{2}{15}\times\frac{1}{14}$
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{34}{35}$		A1	oe eg $\frac{2652}{2730}$ or 0.97(14…) or 97.(14)%
					Total 3 marks

24	$5(x-2)^2$ ..... **or** $5\left[(x-2)^2 .....\right]$ **or** $5\left(x+\frac{-20}{5\times 2}\right)^2+....$ **or** $5(x-b)^2+c$		3	M1	for a start to completing the square **or** correct substitution into $a\left(x+\frac{b}{2a}\right)+....$ from the formula $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}+c$ **or** $a = 5$ embedded in an incorrect final answer in the form $5(x-d)^2+e$ (must be these signs)
	$5\left[(x-2)^2-2^2\right]$..... **or** $5\left[(x-2)^2-4\right]$..... **or** $5\left[(x-2)^2-2^2.....\right]$ **or** $5\left[(x-2)^2-4.....\right]$ **or** $5(x-2)^2-20$.....			M1	for correctly completing the square but terms do not need to be simplified and 23 may or may not be present correct simplification **or** of the first two parts of $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}(+c)$ **NB: Please refer to ALT mark scheme for comparison of coefficients method**
	Correct answer scores full marks (unless from obvious incorrect working)	$5(x-2)^2+3$		A1	oe eg $3+5(x-2)^2$ (if student continues to solve a quadratic equation, ISW)
					Total 3 marks

24 **ALT**	$ax^2 - 2abx + ab^2 + c$		3	M1	for multiplying out $a(x-b)^2 + c$ **or** $a = 5$ embedded in an incorrect final answer in the form $5(x-d)^2 + e$ (must be these signs)
	$-2ab = -20$ **or** $2ab = 20$ **or** $ab^2 + c = 23$			M1	for equating coefficients
	Correct answer scores full marks (unless from obvious incorrect working)	$5(x-2)^2 + 3$		A1	oe eg $3 + 5(x-2)^2$ (if student continues to solve a quadratic equation, ISW)
					Total 3 marks

25	$(a=)\dfrac{2\left(\dfrac{5-2y}{3y}\right)+5}{1-\left(\dfrac{5-2y}{3y}\right)}$ **or** $2\left(\dfrac{5-2y}{3y}\right)+5$ **and** $1-\left(\dfrac{5-2y}{3y}\right)$		3	M1	writing both the numerator and denominator in terms of y, may be seen as one fraction or seen separately
	$(a=)\dfrac{2(5-2y)+5\times3y}{1\times3y-(5-2y)}$ **or** $(a=)\dfrac{10-4y+15y}{3y-5+2y}$ **or** $(a=)\dfrac{10+11y}{5y-5}$ **or** $(a=)\dfrac{\dfrac{2(5-2y)+5\times3y}{3y}}{\dfrac{1\times3y-(5-2y)}{3y}}$ **or** $(a=)\dfrac{\dfrac{10-4y+15y}{3y}}{\dfrac{3y-5+2y}{3y}}$ **or** $(a=)\dfrac{\dfrac{10+11y}{3y}}{\dfrac{5y-5}{3y}}$ **or** $(a=)\dfrac{2(5-2y)+5\times3y}{3y}\times\dfrac{3y}{1\times3y-(5-2y)}$ **or** $(a=)\dfrac{10-4y+15y}{3y}\times\dfrac{3y}{3y-5+2y}$ **or** $(a=)\dfrac{10+11y}{3y}\times\dfrac{3y}{5y-5}$ or			M1	multiplying all terms by $3y$ or a multiple of $3y$ (some simplification may be present) **or** writing numerator and denominator over $3y$ or a multiple of $3y$ **or** multiplying the numerator by the reciprocal of the denominator where the numerator and denominator are separate fractions **or** 3 of a, b, c, d correct if written in the form $\dfrac{a+by}{cy-d}$ or $\dfrac{a+by}{c(y-d)}$ where a, b, c and d are integers **or** for $\dfrac{10+26y}{10y-10}$ oe eg $\dfrac{5+13y}{5(y-1)}$
	Working required	$\dfrac{10+11y}{5(y-1)}$		A1	dep on M1 allow any equivalent fraction with integer values for m, n and p eg $\dfrac{30+33y}{15(y-1)}$
					Total 3 marks

26	eg $(FM =)\dfrac{18}{\tan 60}(=6\sqrt{3}=10.3(9...))$ or eg $(FM =)\sqrt{\left(\dfrac{18}{\sin 60}\right)^2-18^2}\ \left(=\sqrt{\left(12\sqrt{3}\right)^2-18^2}=6\sqrt{3}=10.3(9...)\right)$		5	M1	a correct method for *FM* (may use the length of GM to find FM)
	$(FE =)\dfrac{5}{3}\times"6\sqrt{3}"(=10\sqrt{3}=17.3(2...))$			M1	a correct method for *FE* (correct value of FE implies the first M1)
	$(DF =)\sqrt{\left("10\sqrt{3}"\right)^2+20^2}\left(=\sqrt{700}=10\sqrt{7}=26.4(5...)\right)$ or $(DF =)\sqrt{([\text{their } FE \text{ dep on first M1}])^2+20^2}$ **or** $(GD =)\sqrt{\left(\sqrt{20^2+18^2}\right)^2+\left("10\sqrt{3}"\right)^2}\ \left(=\sqrt{1024}=32\right)$ or $(GD =)\sqrt{\left(\sqrt{20^2+18^2}\right)^2+([\text{their } FE \text{ dep on first M1}])^2}$			M1ft	dep on first M1, a correct calculation for *DF* (using [their *FE* dep on first M1]) **or** dep on first M1, a correct calculation for *GD* (using [their *FE* dep on first M1])
	$\tan GDF=\dfrac{18}{"10\sqrt{7}"}$ or $(GD =)\sqrt{\left("10\sqrt{7}"\right)^2+18^2}\left(=\sqrt{1024}=32\right)$ **and** $\sin GDF=\dfrac{18}{"32"}$ or $\cos GDF=\dfrac{"10\sqrt{7}"}{"32"}$ or $\dfrac{\sin GDF}{18}=\dfrac{\sin 90}{"32"}$ or $18^2="32"^2+"10\sqrt{7}"^2-2\times"32"\times"10\sqrt{7}"\times\cos GDF$ oe			M1ft	a correct trig ratio for *GDF* allow [their *FE* dep on first M1] in place of $"10\sqrt{7}"$ **or** a correct method for *GD* followed by a correct trig statement for *GDF* (trig ratio or sine rule or cosine rule)
	Working required	34.2		A1	dep on M3 allow 34.2 – 34.3
					Total 5 marks

27	$\left(\frac{24+16}{2},\ \frac{15-9}{2}\right)\left(=(20,\ 3)\right)$		5	M1	a correct method to find the midpoint of AC
	$\frac{15--9}{24-16}(=3)$ oe			M1	a correct method to find the gradient of AC
	eg $"3"\times m_2=-1$ (gradient $=-\frac{1}{3}$)			M1ft	a correct method to find the gradient of BD (use of their gradient of AC)
	eg $"3"="-\frac{1}{3}"\times"20"+c$ or $y="-\frac{1}{3}"x+"\frac{29}{3}"$ $y-"3"="-\frac{1}{3}"(x-"20")$			M1ft	using the gradient and midpoint to find the equation of BD (dep on first M1 and previous M1ft)
	Correct answer scores full marks (unless from obvious incorrect working)	$x+3y-29=0$		A1	Answer in correct form but can be any multiple of this eg $2x+6y-58=0$ Allow different position of terms = 0
					Total 5 marks

28	$\left[6x^3+5x^2+x=\right]x(3x+1)(2x+1)$ or $\left[15x^2-x-2=\right](3x+1)(5x-2)$ or $\left[4x^2-1=\right](2x+1)(2x-1)$		4	M1 A correct factorisation of either of these
	eg $(2x=)\dfrac{x(3x+1)(2x+1)}{(2x+1)(2x-1)}\times\dfrac{4(2x-1)}{(3x+1)(5x-2)}\left(=\dfrac{4x}{5x-2}\right)$ or eg $(2x=)\dfrac{x(3x+1)(2x+1)}{(2x+1)(2x-1)}\div\dfrac{(3x+1)(5x-2)}{8x-4}$ or eg $x(3x+1)(2x+1)\times4(2x-1)=2x(2x+1)(2x-1)(3x+1)(5x-2)$ $x(3x+1)(2x+1)\times(8x-4)=2x(2x+1)(2x-1)(3x+1)(5x-2)$			M1 For correct factorisation of 3 or 4 of the numerators/denominators in a correct expression (some cancelling may have taken place) Allow: If the *x* missing on the numerator of the first expression, then the other 3 must be fully factorised eg $(2x=)\dfrac{(3x+1)(2x+1)}{(2x+1)(2x-1)}\times\dfrac{4(2x-1)}{(3x+1)(5x-2)}$ **or** For correct factorisation of 3 or 4 of the numerators/denominators in an equation
	$4x=2x(5x-2)$ oe eg $10x^2-8x=0$			M1 A simplified correct equation with the fraction removed
	Working required	$x=0$ or 0.8		A1 oe dep on M2 from correct working. Both answers needed. If no marks awarded, SCB1 for $48x^4+16x^3-12x^2-4x$ or $60x^4-4x^3-23x^2+x+2$ or $120x^5-8x^4-46x^3+2x^2+4x$
				Total 4 marks