Mark Scheme (Results)

Summer 2023

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 1HR

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2023
Publications Code P72792A
Publications Code 4MA1_1HR_2306_MS

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**

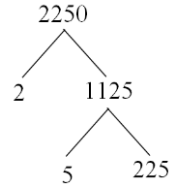
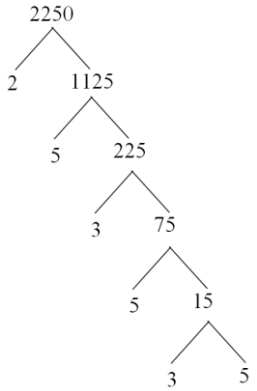
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially 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

Apart from Questions 1, 12, 15, 16 and 18 (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

1	e.g. $2 \times 5 \times 225$ or $5 \times 5 \times 90$ or $5^2 \times 90$ $3 \times 5 \times 150$ or $3 \times 3 \times 250$ or $3^2 \times 250$		3	M1	for 2 correct stages in prime factorisation with 0 incorrect stages or at least 3 stages in prime factorisation with no more than 1 incorrect stage. Each stage gives 2 factors – may be in a factor tree or a table or listed eg 2, 2, 225 (see LHS for examples of the amount of work needed for the award of this mark). Example of 3 stages with 1 incorrect stage: $2250 = 225 \times 100 = 3 \times 5 \times 15 \times 100$ or $225 = 3 \times 5 \times 15$
	e.g. 2 | 2250 5 | 1125 | 225	e.g. 			
	e.g. $2 \times 3 \times 3 \times 5 \times 5 \times 5$			M1	for 2, 3, 3, 5, 5, 5 or $2 \times 3 \times 3 \times 5 \times 5 \times 5$ or $2 , 3^2 , 5^3$ oe or $2 + 3^2 + 5^3$ (ignore 1s) (may be a fully correct factor tree or ladder)
	e.g. 2 | 2250 5 | 1125 3 | 225 5 | 75 3 | 15 5 | 5 | (1)	e.g. 				
	Working required		$2\times3^2\times5^3$		A1 dep on M2 can be any order (allow $2 . 3^2 . 5^3$)
					Total 3 marks

2	(a)(i)		5, 7, 11, 13	1	B1	
	(ii)		5, 6, 8, 10, 12, 14, 15	1	B1	
	(b)		Correct reason	1	B1	eg 9 is not a member of *C* **or** 9 is not in *C* **or** *C* only contains 6, 8, 10, 12, 14 **or** 9 is outside of *C* there must be no contradictory or incorrect statements
						Total 3 marks

3	(a)	eg $\frac{9.6}{6}$ (= 1.6 oe) **or** $\frac{6}{9.6}$ (= 0.625 oe) **or** $\frac{("GH")}{6} = \frac{4}{9.6}$ oe		2	M1	for a correct scale factor accept ratio notation eg 9.6 : 6 (can be seen near the diagram)
		Correct answer scores full marks (unless from obvious incorrect working)	2.5		A1	oe allow 2,5
	(b)	eg 5.7 × "1.6" **or** 5.7 ÷ "0.625" **or** $5.7 \times \frac{4}{"2.5"}$ **or** $5.7 \div \frac{"2.5"}{4}$ **or** $\frac{("BC")}{9.6} = \frac{5.7}{6}$		2	M1	ft their scale factor from (a)
		Correct answer scores full marks (unless from obvious incorrect working)	9.12		A1	oe ft their scale factor from (a) allow 9,12
						Total 4 marks

4	eg $\left(AB^2 =\right)6^2+6^2(=72)$ **or** $\sin 45=\frac{6}{(AB)}$ **or** $\cos 45=\frac{6}{(AB)}$ **or** **or** $\left(AB^2 =\right)6^2+6^2-2\times6\times6\times\cos 90$		5	M1	for a correct start to the method to find *AB*
	eg $(AB=)\sqrt{6^2+6^2}\left(=\sqrt{72}\text{ or }6\sqrt{2}\text{ or }8.48...\right)$ **or** $(AB=)\frac{6}{\sin 45}\left(=\sqrt{72}=6\sqrt{2}=8.48...\right)$ **or** $(AB=)\frac{6}{\cos 45}\left(=\sqrt{72}=6\sqrt{2}=8.48...\right)$ **or** $(AB=)\sqrt{6^2+6^2-2\times6\times6\times\cos 90}$			M1	for a complete method to find the length of *AB*
	eg $\pi\times6(=6\pi\text{ or }18.8...)$ **or** $\pi\times6\div2(=3\pi\text{ or }9.42...)$ **or** $\pi\times\text{"8.48..."}(=26.6...)$ **or** $\pi\times\text{"8.48..."}\div2\ (=13.3...)$			M1	(indep) for a method to find the circumference of one whole circle **or** the arc length of one semicircle seen (may be embedded)
	eg $2\times\text{"}3\pi\text{"}+\text{"13.3..."}$ **or** "9.42" + "9.42" + "13.3" **or** "18.8" + "13.3"			M1	for a complete correct method to find the perimeter of the shape
	Correct answer scores full marks (unless from obvious incorrect working)	32.2		A1	accept answers in the range 32.1 – 32.3
					Total 5 marks

5	eg 0.74×300 (= 222) **or** $1 - 0.74$ (= 0.26) seen **or** $\frac{78}{300}$		2	M1	for a method to work out an estimate for the number of games Evie will win **or** the probability that Evie will lose **or** an answer of $\frac{78}{300}$
	Correct answer scores full marks (unless from obvious incorrect working)	78		A1	cao
					Total 2 marks

6	(a)		m^7	1	B1	
	(b)		8	1	B1	Allow k^8
	(c)		$9x^{12}y^{16}$	2	B2	B1 for a product in the form ax^py^q where 2 from a , p or q are correct eg $3x^{12}y^{16}$ (Allow $9x^{12}$ or $9y^{16}$ or $x^{12}y^{16}$ so as long as not added to any other terms)
						Total 4 marks

7	(a)		$4x^2 - 20x$	1	B1	or $-20x + 4x^2$
	(b)	$(y \pm 5)(y \pm 4)$ or $(5 \pm y)(4 \pm y)$ or $y(y-4)-5(y-4)$ or $y(y-5)-4(y-5)$		2	M1	for $(y \pm 5)(y \pm 4)$ **or** $(5 \pm y)(4 \pm y)$ **or** for $(y + a)(y + b)$ where $ab = 20$ or $a + b = -9$
		Correct answer scores full marks (unless from obvious incorrect working)	$(y - 5)(y - 4)$		A1	oe Allow any letter for y Accept $(5 - y)(4 - y)$
						Total 3 marks

8 (a)		0.0056	1	B1	
(b)	20 000 000 oe eg 20×10^6 or 0.2×10^8 **or** 2×10^n $n \neq 7$ **or** $\frac{6\times10^{(3+5)}}{21+9}$ **or** $\frac{6\times10^8}{30}$ **or** $\frac{6\times10^3}{3\times10^{-4}}$ **or** $\frac{6000}{0.0003}$ **or** $\frac{6000}{3\times10^{-4}}$		2	M1	
	Correct answer scores full marks (unless from obvious incorrect working)	2×10^7		A1	
					Total 3 marks

9	0.12 × 700 000 oe (= 84 000) **or** 0.88 × 700 000 oe (= 616 000) **or** 700 000 × 0.88^2 oe (= 542 080)		3	M1	for finding 12% **or** 88% of 700 000	M2 for 700 000 × 0.88^3 **or** 700 000 × 0.88^4 (= 419 786.75)
	0.88 × "616 000" oe (= 542 080) **and** 0.88 × "542 080" oe (= 477 030.4)			M1	for completing method to find the value of the car	
	Correct answer scores full marks (unless from obvious incorrect working)	477 030		A1	accept 477 030 – 477 031	
					SC: if no other marks gained award M1 for 0.36 × 700 000 oe **or** 252 000 **or** 0.64 × 700 000 oe **or** 448 000 accept (1 − 0.12) as equivalent to 0.88 throughout	
						Total 3 marks

10		Triangle with vertices (3, 6) (3, 9) (5, 6)	2	B2	for a fully correct shape with correct orientation and in the correct position. (B1 for a shape of correct size and orientation **or** 2 or 3 points plotted correctly)
					Total 2 marks

11	$(V=)\frac{1950}{7.8}(=250)$ **or** $7.8=\frac{1950}{w\times5\times4}$ or $7.8=\frac{1950}{w\times20}$		3	M1	for correct method to find volume using mass ÷ density **or** a correct equation with correct expression for volume (may be embedded in another calculation)
	eg $w=\frac{1950}{7.8\times5\times4}$ **or** $20w=\frac{1950}{7.8}$ **or** $20w$ = "250" **or** $4\times5\times w$ = "250" **OR** eg $\frac{1950}{5\times4\times7.8}$ **or** 1950 ÷ (20 ×7.8) **or** 1950 ÷ 156 **or** "250" ÷ 20			M1	for a fully correct equation in w **or** a fully correct calculation to find the value of w (may be labelled eg x or L)
	Correct answer scores full marks (unless from obvious incorrect working)	12.5		A1	
					Total 3 marks

12	(a)	eg $x + 0.15 + 0.5 + y + 0.13 + 0.03 = 1$ oe **or** $x + y = 1 - 0.15 - 0.5 - 0.13 - 0.03$ oe **or** $x + y + 0.81 = 1$ oe **or** $x + y = 1 - 0.81$ oe **or** $1 - 0.15 - 0.5 - 0.13 - 0.03 = 0.19$ oe **or** $1 - 0.81 = 0.19$ oe			2	M1	for setting up an equation in x and y using the sum of probabilities equals 1 **or** for showing that probabilities add up to 1
		Working required		Shown		A1	correctly rearranges to $x + y = 0.19$ (must be shown from a correct method) **or** a clear statement that $x + y = 0.19$
	(b)	$x + y = 0.19$ $3x - y = 0.09$ Adding ($x + 3x = 0.19 + 0.09$ or $4x = 0.28$) **or** $3x - (0.19 - x) = 0.09$ or $x + 3x - 0.09 = 0.19$	$3x + 3y = 0.57$ $3x - y = 0.09$ Subtracting ($3y - - y = 0.57 - 0.09$ or $4y = 0.48$) **or** $3(0.19 - y) - y = 0.09$ or $\left(\frac{0.09 + y}{3}\right) + y = 0.19$		3	M1	for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operator to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting (condone missing brackets)
		"0.07" + $y = 0.19$ or $3 \times$ "0.07" $- y = 0.09$ **or** $y = 0.19 -$ "0.07" or $y = 3 \times$ "0.07" $- 0.09$	$3x + 3 \times$ "0.12" $= 0.57$ or $3x -$ "0.12" $= 0.09$ **or** $x = 0.19 -$ "0.12" or $x = \left(\frac{0.09 + "0.12"}{3}\right)$			M1	dep on first M1for a correct method to find other variable by substitution of found variable into one equation **or** for repeating the above method to find the second variable.
		Working required		$x = 0.07$ and $y = 0.12$		A1	oe dep on M1
							Total 5 marks

13	(a)		0.1 and 0.6	1	B1	oe
	(b)	0.7×0.9 or $1 - (0.7 \times$ "0.1" $+ 0.3 \times 0.4 + 0.3 \times$ "0.6")		2	M1	must be considering one correct product only or 1 – (all 3 correct products only) allow ft if using 1 – P(WL or LW or LL)
		Correct answer scores full marks (unless from obvious incorrect working)	0.63		A1	oe eg 63% or $\frac{63}{100}$ allow ft if using 1 – P(WL or LW or LL)
						Total 3 marks

14	(a)		15, 31, 52, 66, 74, 80	1	B1	
	(b)			2	M1	ft from table for at least 5 points plotted correctly at end of interval **or** ft from sensible table for all 6 points plotted consistently within each interval in the **freq table** at the correct height
			Correct cf curve		A1	accept curve or line segments accept curve that is not joined at (50,0)
	(c)	*Correct answer scores full marks (unless from obvious incorrect working)*	73 – 75	1	B1ft	ft their cumulative frequency graph
	(d)	NB: readings are 62.5 – 64 and 85 – 86.5 (but for this M1 these do not have to be correct if correct working is shown – eg lines or marks indicating use of CF 20 (or 20.25)and CF 60 (or 60.75) with an indication on the Time Taken axis at the correct points (or they can just show the correct readings))		2	M1ft	For correct use of LQ and UQ, ft from a cum freq graph provided method is shown – eg a line horizontally to the graph from readings of CF 20 and CF 60 to meet the graph and then a vertical line to the Time Taken axis (even if wrongly read scale) **or** clear marks on the graph and Time Taken axis that correspond to the correct readings **or** correct values from the Time Taken axis
		If answer is in the given range, then award the marks – unless from obvious incorrect working	21 to 24		A1ft	Accept a single value in range 21 to 24 or ft from their cumulative frequency graph provided method is shown
		Correct answer scores full marks (unless from obvious incorrect working)				**Total 6 marks**

15	eg $(6-2)\times 180\ (=720)$		4	M1	for a method to find the sum of the interior angles for a hexagon
	eg $"720"-(90+95+149+104+57)(=225)$			M1	for a method to find the missing angle in the hexagon
	eg $\frac{360}{"225"-180}$ **or** $\frac{360}{"45"}$ **or** $\frac{180(n-2)}{n}=360-"225"$ oe **or** $\frac{180(n-2)}{n}="135"$			M1	for a complete method
	Working required	8		A1	cao dep on M2 NB: the answer of 8 can be gained from assuming that *AB* splits reflex *GBC* into 2 equal angles – without gaining the first 2 method marks [M0M0 is awarded] Award SCB1 for the student who gains an answer of 8 from this assumption or trial and improvement or no method shown
					Total 4 marks

16		eg $10\,000x = 1767.67\ldots$ $100x = 17.67\ldots$ **or** $1000x = 176.76\ldots$ $10x = 1.76\ldots$ **or** $100x = 17.676\ldots$ $x = 0.176\ldots$ oe		2	M1	for 2 recurring decimals that when subtracted give a whole number or terminating decimal (17.5 or 175 or 1750 etc) eg $10\,000x = 1767.67...$ and $100x = 17.676....$ **or** $1000x = 176.76\ldots$ and $10x = 1.7676\ldots$ **or** $100x = 17.676\ldots$ and $x = 0.17676\ldots$ with intention to subtract. (if recurring dots not shown in both numbers then showing at least **one** of the numbers to at least 5sf) **or** $0.1 + 0.0\dot{7}\dot{6}$ **and** eg $100x = 7.6767...$, $x = 0.07676...$ with intention to subtract.
		eg $10\,000x - 100x = 1767.67... - 17.67... = 1750$ **and** $\frac{1750}{9900} = \frac{35}{198}$ **or** $1000x - 10x = 176.76... - 1.76... = 175$ **and** $\frac{175}{990} = \frac{35}{198}$ **or** $100x - x = 17.676... - 0.176... = 17.5$ **and** $\frac{17.5}{99} = \frac{35}{198}$ **or** eg $10x - x = 7.6767... - 0.07676... = 7.6$ **and** $0.1 + \frac{7.6}{99} = \frac{0.1 \times 99 + 7.6}{99} = \frac{17.5}{99} = \frac{35}{198}$ oe	shown		A1	for completion to $\frac{35}{198}$ dep on M1
		Working required				**Total 2 marks**

17	(a)	$F = \frac{k}{r^2}$ or $kF = \frac{1}{r^2}$		3	M1	(NB. Not for $F = \frac{1}{r^2}$) Constant of proportionality must be a symbol such as k	M2 for $36 = \frac{k}{4^2}$ oe
		$36 = \frac{k}{4^2}$ oe **or** $k = 36 \times 4^2$ **or** $k = 576$			M1	for substitution of F and r into a correct formula	
		Correct answer scores full marks (unless from obvious incorrect working)	$F = \frac{576}{r^2}$		A1	oe e.g $F = 576(\times)\frac{1}{r^2}$ Award 3 marks if answer is $F = \frac{k}{r^2}$ on the answer line and $k = 576$ clearly given in the body of working of the script	
	(b)		0.25	1	A1ft	oe dep on M1 in part (a) and for their value of k if $F = \frac{k}{r^2}$	
							Total 4 marks

18	47.5 **or** 52.5 **or** 1.25 **or** 1.35		4	B1	for a correct bound, accept 4750 **or** 5250 **or** 125 **or** 135 if working in cm
	eg $\frac{47.5}{1.35}(=35.18...)$ **or** $\frac{52.5}{1.25}(=42)$			M1	for correct substitution of 47.5 □ LB_F < 50 **and** 1.3 < UB_{FP} □ 1.35 **or** 50 < UB_F □ 52.5 **and** 1.25 □ LB_{FP} < 1.3
	eg ("42"−"36")×8.65 **or** "42" × 8.65 – "36" × 8.65 **or** 363.3 – 311.4			M1	(dep on M1) for using **their** lower and upper bounds for the number of fence panels needed to find the cost – lower bound and/or upper bound must be an integer rounded up
	Working required	51.9(0)		A1	cao dep on M2
					Total 4 marks

19	eg $\begin{pmatrix}7\\-2\end{pmatrix}+\begin{pmatrix}-3\\5\end{pmatrix}$ **or** $\begin{pmatrix}4\\3\end{pmatrix}$ **or** $-\begin{pmatrix}7\\-2\end{pmatrix}-\begin{pmatrix}-3\\5\end{pmatrix}$ **or** $\begin{pmatrix}-4\\-3\end{pmatrix}$		5	M1	for a method for finding $\overrightarrow{AC}$ or $\overrightarrow{CA}$ or for sight of $\begin{pmatrix}4\\3\end{pmatrix}$ or $\begin{pmatrix}-4\\-3\end{pmatrix}$
	eg $\left(\overrightarrow{AC}=\right)\sqrt{"4"^2+"3"^2}\left(=\sqrt{25}=5\right)$			M1	(dep on previous M1) for a method to find the magnitude of $\overrightarrow{AC}$ or $\overrightarrow{CA}$
	eg $\left(\overrightarrow{AB}=\right)\sqrt{7^2+(\pm2)^2}\left(=\sqrt{53}=7.28(010)\right)$ **or** $\left(\overrightarrow{BC}=\right)\sqrt{(\pm3)^2+5^2}\left(=\sqrt{34}=5.83(095)\right)$			M1	(indep) for a method to find the magnitude of either $\overrightarrow{AB}$ **or** $\overrightarrow{BC}$
	$"\sqrt{7^2+(\pm2)^2}"+"\sqrt{(\pm3)^2+5^2}"$ **or** $"\sqrt{53}"+"\sqrt{34}"\left(=13.1(110)\right)$ **or** "7.28" + "5.83" (= 13.1(110))			M1	(dep on previous M1) for a complete method to find Pru's distance travelled
	Correct answer scores full marks (unless from obvious incorrect working)	8.1		A1	accept 8.1 – 8.2, to award full marks $\overrightarrow{AC}$ must be correct
					Total 5 marks

20	(a)(i)			(3, 10)	1	B1
	(ii)			(3, −2)	1	B1
	(iii)			(−3, 5)	1	B1
	(b)	$(x \pm 2)$	$(x+3.5\pm 2)$..... or $\left(x+\frac{7}{2}\pm 2\right)$...		4	M1 for sight or use of $(x \pm 2)$ or $(x + 1.5)$ or $(x + 5.5)$
		$(x-2)^2+7(x-2)+20$	$(x+3.5-2)^2-3.5^2+20$ or $(x+1.5)^2+7.75$			M1 for correct substitution or correct use of $(x – 2)$ for x into **L**
		$x^2-4x+4+7x-14+20$	$x^2+3x+2.25-12.25+20$ or $x^2+3x+2.25+7.75$			M1 dep on M2 for expanding brackets **correctly**
		Correct answer scores full marks (unless from obvious incorrect working)		$x^2+3x+10$		A1
						Total 7 marks

21 (a)	$3x^2$ or $-2\times2x$ or $-4x$ or -9 oe		2	M1	for differentiating one term correctly
		$3x^2-4x-9$		A1	for a correct expression Allow $3x^2-2\times2x-9$
(b)	$(x=)\dfrac{4\pm\sqrt{(-4)^2-(4\times3\times-9)}}{2\times3}$ **or** $3\left[\left(x-\dfrac{2}{3}\right)^2-\left(\dfrac{2}{3}\right)^2\right]-9(=0)$		4	M1	for finding the critical values for a 3-term quadratic using any correct method - if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\dfrac{4\pm\sqrt{16+108}}{6}$ oe **or** eg $3\left(x-\dfrac{2}{3}\right)^2-10\dfrac{1}{3}$ oe)
		-1.19 and 2.52		A1	for critical values of -1.19 **and** 2.52 or better (for this A1 mark allow -1.2 or -1.18 **and** 2.5 **or** $\dfrac{2\pm\sqrt{31}}{3}$ oe)
		$x<-1.19$		A1	awrt -1.19
		$x>2.52$		A1	awrt 2.52
					Total 6 marks

22	e.g. 20 × 9 (= 180) or 20 × 0.9 (= 18) or 20 × 1.8 (= 36) or (4 × 25) + (4 × 20) (= 180) oe or 4 × 0.9 (= 3.6) or 4 × 1.8 (7.2)		4	M1	for a method to find the area of the 55 - 75 bar
	e.g. 5 × 16 + 5 × 50 + 10 × 33 + 10 × 19 + 25 × 9 (= 1075) or 5 × 1.6 + 5 × 5 + 10 × 3.3 + 10 × 1.9 + 25 × 0.9 (= 107.5) or 5 × 3.2 + 5 × 10 + 10 × 6.6 + 10 × 3.8 + 25 × 1.8 (= 215) or (3×25 + 5) + (10×25) + (12×25 + 2×15) + (6×25 + 2×20) + (5×25 + 5×20) (= 1075) or 1 × 1.6 + 1 × 5 + 2 × 3.3 + 2 × 1.9 + 5 × 0.9 (= 21.5) or 1 × 3.2 + 1 × 10 + 2 × 6.6 + 2 × 3.8 + 5 × 1.8 (= 43)			M1	for a method to find the total area **Using 5 bars** (products or areas) eg 80 + 250 + 330 + 190 + 225 or 16 + 50 + 66 + 38 + 45 allow one error or omission **Using 6 bars** (products or areas) eg 80 + 250 + 330 + 190 + 45 + "180" or 16 + 50 + 66 + 38 + 9 + "36" allow one error or omission
	e.g. $\frac{180}{1075}(\times 100)$ or $\frac{18}{107.5}(\times 100)$ or $\frac{36}{215}(\times 100)$ or $\frac{3.6}{21.5}(\times 100)$ or $\frac{7.2}{43}(\times 100)$ or 0.167(441…) (× 100)			M1	for a method to find a fraction aged 55+ or percentage aged 55+ using all **correct** values only
	Correct answer scores full marks (unless from obvious incorrect working)	16.7		A1	awrt 16.7
					Total 4 marks

23	$(x+2)(x-2)$ oe or $(4x+1)(x-2)$ oe		4	M1	for complete factorisation of x^2-4 **or** $4x^2-7x-2$ Each factor must be in the form $(ax \pm b)$ where a and b are integers
	$(x+2)(x-2)\times\frac{x}{(4x+1)(x-2)}$ or $\frac{x(x+2)(x-2)}{(4x+1)(x-2)}$ or $\frac{x(x+2)}{(4x+1)}$			M1	for complete factorisation of $4x^2-7x-2$ **and** x^2-4 and inverting and intention to multiply
	$\frac{x(x+2)-2x(4x+1)}{(4x+1)}$ or $\frac{x^2+2x-8x^2-2x}{(4x+1)}$ or $\frac{x(x+2)}{(4x+1)}-\frac{2x(4x+1)}{(4x+1)}$ or $\frac{x^2+2x}{(4x+1)}-\frac{8x^2+2x}{(4x+1)}$			M1	for a correct single fraction following correct cancellation or for two correct fractions with common denominator following correct cancellation
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{-7x^2}{4x+1}$		A1	oe but must be in form $\frac{ax^2}{bx+c}$ where a, b and c are integers.
					Total 4 marks

23 ALT	$\frac{-7x^3+14x^2}{4x^2-7x-2}$ oe		4	M1	for a correct single fraction
	$\frac{-7x^2(x-2)}{(4x+1)(x-2)}$ oe			M1	for complete factorisation of $-7x^3+14x^2$ **or** $4x^2-7x-2$ Each factor must be in the form $(ax \pm b)$
	$\frac{-7x^2(x-2)}{(4x+1)(x-2)}$ oe			M1	for complete factorisation of $-7x^3+14x^2$ **and** $4x^2-7x-2$ Each factor must be in the form $(ax \pm b)$
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{-7x^2}{4x+1}$		A1	oe but must be in form $\frac{ax^2}{bx+c}$ where a, b and c are integers.
					Total 4 marks

24	2^3 **and** 2^{4x} or $(2^4)^x$		5	M1	for writing 16^x **and** 8 as a power of 2 (or all as powers of 4,8 or 16)
	$n = x^2 + 4x + 3$ oe or $x^2 + 4x + 3 - n = 0$			A1	for writing n in terms of x correct expression implies first M1
	$(n =)(x+2)^2 - 2^2 \ldots\ldots$ oe or $(x =) -2 \pm \sqrt{n+1}$ $(x =) \dfrac{-4 \pm \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe			M1	for a correct first step in completing the square or using the quadratic formula correctly ft their 3 term quadratic
	$(x =) -2 + \sqrt{n+1}$ oe or $(x =) \dfrac{-4 + \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe			A1	for correctly rearranging to make x the subject (must be positive square root)
	Correct answer scores full marks (unless from obvious incorrect working)	$(x =) -2 + \sqrt{n+1}$ **and** $n > 3$		A1	must be positive square root Accept $(x =) \sqrt{n+1} - 2$ oe and $3 < n$ Accept $(x =) \dfrac{-4 + \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe **and** $n > 3$ or $3 < n$
					Total 5 marks

24 **ALT**	$4^{\frac{1}{2}n}$, $4^{\frac{1}{2}x^2}$, 4^{2x} **and** $4^{\frac{3}{2}}$	$8^{\frac{1}{3}n}$, $8^{\frac{1}{3}x^2}$ **and** $8^{\frac{4}{3}x}$	$16^{\frac{1}{4}n}$, $16^{\frac{1}{4}x^2}$ **and** $16^{\frac{3}{4}}$		5	M1	for all as powers of 4 or 8 or 16
	$n = x^2 + 4x + 3$ oe or $x^2 + 4x + 3 - n = 0$					A1	for writing n in terms of x correct expression implies first M1
	$(n =)(x+2)^2 - 2^2$ ..... oe or $(x =) -2 \pm \sqrt{n+1}$ $(x =) \dfrac{-4 \pm \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe					M1	for a correct first step in completing the square or using the quadratic formula correctly ft their 3 term quadratic
	$(x =) -2 + \sqrt{n+1}$ oe or $(x =) \dfrac{-4 + \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe					A1	for correctly rearranging to make x the subject (must be positive square root)
	Correct answer scores full marks (unless from obvious incorrect working)			$(x =) -2 + \sqrt{n+1}$ **and** $n > 3$		A1	must be positive square root Accept $(x =) \sqrt{n+1} - 2$ oe and $3 < n$ Accept $(x =) \dfrac{-4 + \sqrt{4^2 - 4\times1\times(3-n)}}{2}$ oe **and** $n > 3$ or $3 < n$
							Total 5 marks

25	eg $\frac{1}{2}(2x-1)(2x+1)\sin 30 = x^2 + x - 3.75$ oe		6	M1	for equating area of triangle with the given area
		3.5		A1	for the value of x
	$(BC^2 =)"6"^2 + "8"^2 - (2\times"6"\times"8"\times\cos 30)\ (=16.8(615...))$ oe or $(BC =)\ \sqrt{"16.8..."}\ (= 4.10(628\ldots))$			M1	ft dep on M1 for a correct method to find BC^2 or BC ($AB = 6$ and $AC = 8$)
	$\frac{\sin(ABC)}{"8"} = \frac{\sin 30}{\sqrt{"16.8"}}$ oe or $\frac{\sin(BCA)}{"6"} = \frac{\sin 30}{\sqrt{"16.8"}}$ oe or $"6"^2 = "8"^2 + \left(\sqrt{"16.8"}\right)^2 - \left(2\times"8"\times\sqrt{"16.8"}\times\cos(BCA)\right)$ oe or $"8"^2 = "6"^2 + \left(\sqrt{"16.8"}\right)^2 - \left(2\times"6"\times\sqrt{"16.8"}\times\cos(ABC)\right)$ oe			M1	ft dep on previous M1 for a correct method to find angle ABC or angle BCA
	$(\sin ABC =)\frac{\sin 30\times"8"}{\sqrt{"16.8"}}(=0.974...)$ oe or $ABC = 76.9\ldots$ or $(\sin BCA =)\frac{\sin 30\times"6"}{\sqrt{"16.8"}}(=0.730...)$ oe or $BCA = 46.9\ldots$ or $(\cos BCA =)\frac{"8"^2 + \left(\sqrt{"16.8"}\right)^2 - "6"^2}{2\times"8"\times\left(\sqrt{"16.8"}\right)}(=0.682...)$ oe or $BCA = 46.9\ldots$ or $(\cos ABC =)\frac{"6"^2 + \left(\sqrt{"16.8"}\right)^2 - "8"^2}{2\times"6"\times\left(\sqrt{"16.8"}\right)}(=-0.226...)$ oe or $ABC = 103.0\ldots$			M1	ft dep on previous M1 for a correct rearrangement for sin ABC or sin BCA or cos BCA or cos ABC
	Correct answer scores full marks (unless from obvious incorrect working)	103		A1	accept awrt 103
					Total 6 marks

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom