



Mathematics

Paper 5

(Non-Calculator)

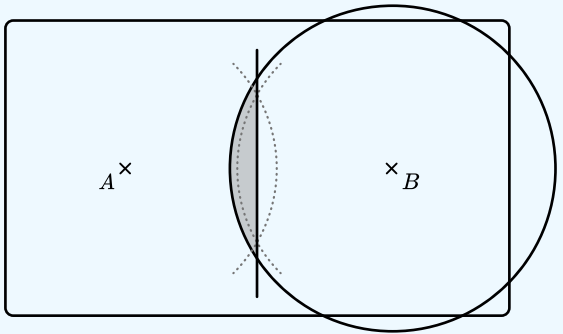
Higher Tier

Mark Scheme

OCR GCSE

SET 3

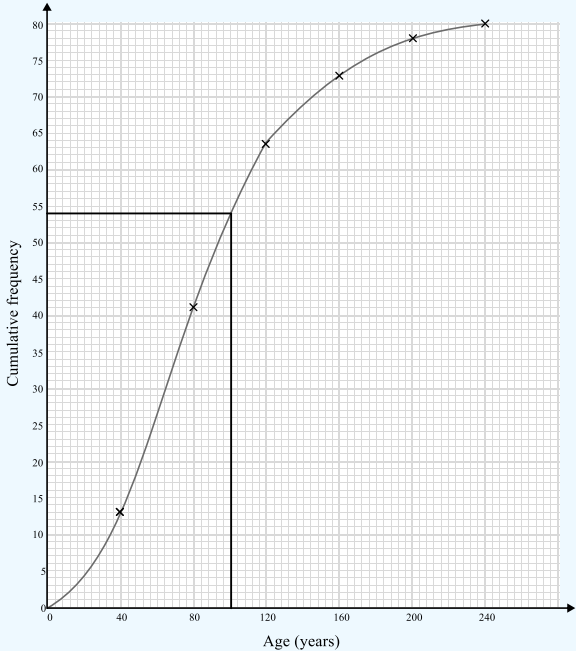
Question	Working	Answer	Notes
Q1	$\frac{9}{4} \times \frac{5}{3} = \frac{45}{12} = \frac{15}{4} = 3\frac{3}{4}$	$3\frac{3}{4}$	M1 $\frac{9}{4}$ and $\frac{5}{3}$ M1 Attempts to multiply their numerators and denominators A1 cao
Q2a	<div><div><div>208</div><div><div>2</div><div>104</div></div><div><div><div>2</div><div>52</div></div><div><div><div>2</div><div>26</div></div><div><div><div>2</div><div>13</div></div></div></div></div><div>$2^4 \times 13$</div></div><td>4</td><td>A1 cao</td></div>	4	A1 cao
Q2b	$78 = 2 \times 3 \times 13$ $HCF: 2 \times 13 = 26$	26	M1 78 written as product of primes OR at least 6 correct factors of 78 listed M1 Identifies common prime factors OR identifies a common factor A1 cao

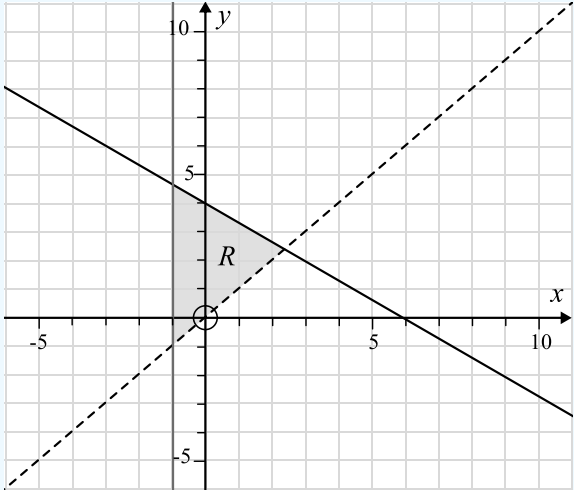
Question	Working	Answer	Notes
Q3			<p>B1 Perpendicular bisector of AB constructed (construction lines must be seen)</p> <p>B1 Circle or part circle, radius $4cm$ around B</p> <p>B1 Correct area shaded</p>
Q4	$2 \text{ litres} = 2000ml$ $75\% \text{ of } 2000ml: 2000 \div 4 = 500,$ $500 \times 3 = 1500ml$ $240 \times 6 = 1440ml$	No	<p>M1 $240 \times 6 = 1440ml$</p> <p>M1 $2 \text{ litres} = 2000ml$ seen or implied</p> <p>M1 $75\% \text{ of } 2000 = 1500ml$</p> <p>OR $\frac{1440}{2000} \times 100 = \frac{72}{100} \times 100 = 72\%$</p> <p>A1 Correct answer following correct working</p>
Q5	$300 \div 3 = 100$ $100 \times 50p = \text{£}50$ $50 - 40 = 10, \text{ profit} = \text{£}10$ $\frac{10}{40} \times 100 = 25\%$	25%	<p>M1 $300 \div 3 = 100$ or $100 \times 50p = \text{£}50$</p> <p>M1 $50 - 40 = 10, \text{ profit} = \text{£}10$</p> <p>M1 Attempt to calculate the percentage profit</p> <p>A1 cao</p>
Q6	$3.65 \times 10^5 = 365000$ $36.5 \times 10^{-2} = 0.365$	0.0365 36.5×10^{-2} 365 3.65×10^5	<p>M1 365000 or 0.365 seen</p> <p>A1 cao</p>

Question	Working	Answer	Notes
Q7	<p>Angle $BHG = 90^\circ$</p> <p>Interior angle of a hexagon: $\frac{4 \times 180}{6} = 120^\circ$</p> <p>Angle $ABH = 120 - 90 = 30$</p> <p>$90 = 3 \times 30$ so angle $BHG = 3 \times$ angle ABH</p>		<p>B1 Angle $BHG = 90^\circ$</p> <p>M1 Attempt at a correct method to find the interior angle of a hexagon</p> <p>M1 <i>ft</i> Angle $ABH =$ their '120' $- 90$</p> <p>B1 Concluding statement</p>
Q8a	<p>Volume estimate: $10 \times 10 \times 10 = 1000$</p> <p>Density estimate: $\frac{600}{1000} = 0.6g/cm^3$</p>	$0.6g/cm^3$	<p>M1 Rounds 10.1 to 10</p> <p>M1 Rounds 594 to 600</p> <p>M1 $10 \times 10 \times 10 = 1000$</p> <p>A1 cao</p>
Q8b		Over-estimate	B1
Q9a	<p>$\frac{1}{2} \times 4 \times 7 = 14$</p> <p>$14 \times 10 = 140m^3$</p>	$140m^3$	<p>M1 Area of cross-section = $14m^2$</p> <p>A1 cao</p>
Q9b	<p>$60 = \frac{F}{70}$</p> <p>$F = 60 \times 70 = 4200N$</p> <p>$P = \frac{4200}{40} = 105 \text{ newtons}/m^2$</p>	$105 \text{ newtons}/m^2$	<p>M1 $60 = \frac{F}{70}$ oe</p> <p>M1 $F = 4200N$</p> <p>A1 cao</p>

Question	Working	Answer	Notes
Q10	Total height of boys: $6 \times 130 = 780$ Total height of girls: $4 \times 120 = 480$ Total height of 10 players: $780 + 480 = 1260$ Mean height of 10 players: $\frac{1260}{10} = 126$	Yes	M1 $6 \times 130 = 780$ or $4 \times 120 = 480$ M1 $780 + 480 (= 1260)$ M1 $1260 \div 10$ A1 Concludes 'Yes' with correct working
Q11a	$3 \times 4 = 12$ $12p^{2+3} q^{1+2} = 12p^5 q^3$	$12p^5 q^3$	M1 12 or p^5 or q^3 seen A1 cao
Q11b	$a = 4(2m^2)^3$ $a = 4 \times 8m^6$ $a = 32m^6$	$a = 32m^6$	M1 $a = 4(2m^2)^3$ A1 cao
Q11c	$32^{\frac{1}{2}} \times 2^{-2} = (2^5)^{\frac{1}{2}} \times 2^{-2}$ $= 2^{\frac{5}{2}} \times 2^{-2}$ $= 2^{\frac{1}{2}}$ Or $4\sqrt{2} \times \frac{1}{4} = \sqrt{2} = 2^{\frac{1}{2}}$	$2^{\frac{1}{2}}$	M1 Writes 32 as 2^5 or $4\sqrt{2}$ M1 Writes $\frac{1}{2^2}$ in a form which allows them to simplify the expression A1 cao written in index form

Question	Working	Answer	Notes														
<div>Q12a</div>	<table><tr><th>Age (A years)</th><th>Cumulative frequency</th></tr><tr><td>$0 < A \leq 40$</td><td>13</td></tr><tr><td>$0 < A \leq 80$</td><td>41</td></tr><tr><td>$0 < A \leq 120$</td><td>64</td></tr><tr><td>$0 < A \leq 160$</td><td>73</td></tr><tr><td>$0 < A \leq 200$</td><td>78</td></tr><tr><td>$0 < A \leq 240$</td><td>80</td></tr></table>	Age (A years)	Cumulative frequency	$0 < A \leq 40$	13	$0 < A \leq 80$	41	$0 < A \leq 120$	64	$0 < A \leq 160$	73	$0 < A \leq 200$	78	$0 < A \leq 240$	80		A1
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<div>Q12b</div>			M1 At least 4 points plotted correctly A1 All points correct and joined with an appropriate curve														

Question	Working	Answer	Notes
Q12c	 <p>54 trees less than 100 years old</p> <p>$80 - 54 = 26$ trees over 100 years old</p>	$\frac{26}{80}$	<p>M1 Line drawn at 100 years and value of 53 - 55, read from their graph</p> <p>M1 Subtracts their '54' from 80</p> <p>A1 $\frac{26}{80}$ oe</p>
Q13	$\frac{28}{36} : \frac{22}{40} : \frac{16}{30} = \frac{280}{360} : \frac{198}{360} : \frac{192}{360}$ $= 280 : 198 : 192$ $= 140 : 99 : 96$	$140 : 99 : 96$	<p>M1 $\frac{28}{36}, \frac{22}{40}, \frac{16}{30}$</p> <p>M1 Writes fractions with common denominator</p> <p>A1 cao</p>

Question	Working	Answer	Notes
Q14			M1 Line $y = x$ drawn with solid line M1 Line $y = x$ drawn with dotted line B1 A region which correctly satisfies at least one of the inequalities identified B1 A region which correctly satisfies at least two of the inequalities identified A1 Fully correct solution
Q15a	$5 \div 6 = 0.83333....$	0.83333 or $0.8\dot{3}$	M1 Attempt to divide 5 by 6 A1 cao
Q15b	$x = 0.4353535...$ $10x = 4.353535...$ $1000x = 435.353535....$ $1000x - 10x = 431$ $990x = 431$ $x = \frac{431}{990}$	$\frac{431}{990}$	M1 $10x$ and $1000x$ seen M1 Attempt to subtract $10x$ from $1000x$ A1 Correct fraction with correct steps shown

Question	Working	Answer	Notes
Q16	$\frac{\theta}{360} \times \pi \times 3^2 = 2$ $\frac{9\theta}{360} = 2$ $\theta = \frac{720}{9} = 80^\circ$ $\text{Arc length: } \frac{80}{360} \times 2 \times \pi \times 3 = \frac{4}{3} \pi$ $\text{Perimeter: } 6 + \frac{4}{3} \pi$	$6 + \frac{4}{3} \pi \text{ cm}$	<p>M1 $\frac{\theta}{360} \times \pi \times 3^2 = 2\pi$</p> <p>M1 $\theta = \frac{720}{9} = 80^\circ$</p> <p>M1 <i>ft</i> Arc length: $\frac{\text{their '80'}}{360} \times 2 \times \pi \times 3$</p> <p>M1 Arc length = $\frac{4}{3} \pi$</p> <p>M1 <i>ft</i> their '$\frac{4}{3} \pi$' + 6</p> <p>A1 cao</p>
Q17	$\sin(30) = \frac{1}{2}, \cos(30) = \frac{\sqrt{3}}{2}$ $6 \times \frac{1}{2} \times 2 \times \frac{\sqrt{3}}{2} = 6 \times \frac{\sqrt{3}}{2} = 3\sqrt{3}$	$a = 3$	<p>M1 $\sin(30) = \frac{1}{2}, \cos(30) = \frac{\sqrt{3}}{2}$ seen or implied</p> <p>M1 $6 \times \frac{1}{2} \times 2 \times \frac{\sqrt{3}}{2} = 3\sqrt{3}$</p> <p>A1 cao</p>
Q18	$0.6 \times 0.4 + 0.4 \times 0.1 = 0.24 + 0.04$ $= 0.28$	0.28	<p>M1 Tree diagram drawn or attempt at 'walks and late' and 'bus and late'</p> <p>M1 $0.6 \times 0.4 = 0.24$</p> <p>M1 $0.4 \times 0.1 = 0.04$</p> <p>A1 cao</p>
Q19	$P = \frac{k}{Q^2}$ $1.5 = \frac{k}{10^2}, k = 1.5 \times 100 = 150$ $P = \frac{150}{5^2} = \frac{150}{25} = 6$	$P = 6$	<p>M1 $1.5 = \frac{k}{10^2}$</p> <p>M1 $k = 150$</p> <p>A1 cao</p>

Question	Working	Answer	Notes
Q20	$(x + 5)^2 + (x - 2)^2 = (x + 6)^2$ $x^2 + 10x + 25 + x^2 - 4x + 4 = x^2 + 12x + 36$ $x^2 - 6x - 7 = 0$ $(x + 1)(x - 7) = 0$ $x = -1$ (invalid) or $x = 7$	$x = 7$	M1 $(x + 5)^2 + (x - 2)^2 = (x + 6)^2$ M1 $x^2 - 6x - 7 = 0$ M1 Valid attempt to solve their quadratic A1 cao (must disregard $x = -1$)
Q21	$b = -6$ $0 = 1^2 + a - 6, a = 5$ $y = x^2 + 5x - 6$ $y = (x + \frac{5}{2})^2 - (\frac{5}{2})^2 - 6$ $y = (x + \frac{5}{2})^2 - \frac{49}{4}$	$(-\frac{5}{2}, -\frac{49}{4})$	M1 $b = -6$ M1 $0 = 1^2 + a - 6, a = 5$ M1 Correct method to determine x coordinate $= -\frac{5}{2}$ A1 cao
Q22	$x = 3y$ $2x + 2z = 26 \Rightarrow 6y + 2z = 26$ $y + 2z = 11$ $5y = 15$ $y = 3$ $x = 3 \times 3 = 9$ $3 + 2z = 11$ $z = 4$	$x = 9$ $y = 3$ $z = 4$	M1 $2x + 2z = 26$ M1 $y + 2z = 11$ M1 $x = 3y$ and substitutes into one of the first to equations to get 2 equations in 2 variables M1 Valid attempt to solve simultaneous equations A1 cao

Question	Working	Answer	Notes
Q23	$M = \frac{\sqrt{90}}{2 + \sqrt{10}} = \frac{3\sqrt{10}}{2 + \sqrt{10}}$ $= \frac{3\sqrt{10}(2 - \sqrt{10})}{(2 + \sqrt{10})(2 - \sqrt{10})}$ $= \frac{6\sqrt{10} - 30}{4 - 10}$ $= \frac{6\sqrt{10} - 30}{-6}$ $= 5 - \sqrt{10}$	$5 - \sqrt{10}$	<p>M1 $M = \frac{\sqrt{90}}{2 + \sqrt{10}}$</p> <p>M1 Multiplies by $\frac{2 - \sqrt{10}}{2 - \sqrt{10}}$</p> <p>M1 Reaches $\frac{6\sqrt{10} - 30}{-6}$</p> <p>A1 cao</p>
Q24a	$A = h \times b \Rightarrow 54 = h \times b$ $h = \frac{54}{b}$		A1 correct steps shown
Q25b	$2h + 2b = 33$ $2\left(\frac{54}{b}\right) + 2b = 33$ $108 + 2b^2 = 33b$ $2b^2 - 33b + 108 = 0$ $(2b - 9)(b - 12) = 0$ $b = \frac{9}{2} \text{ or } b = 12$	$\frac{9}{2}$ and 12	<p>M1 $2h + 2b = 33$ and substitutes $\frac{54}{b}$</p> <p>M1 Reaches $2b^2 - 33b + 108 = 0$</p> <p>A1 cao</p>

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