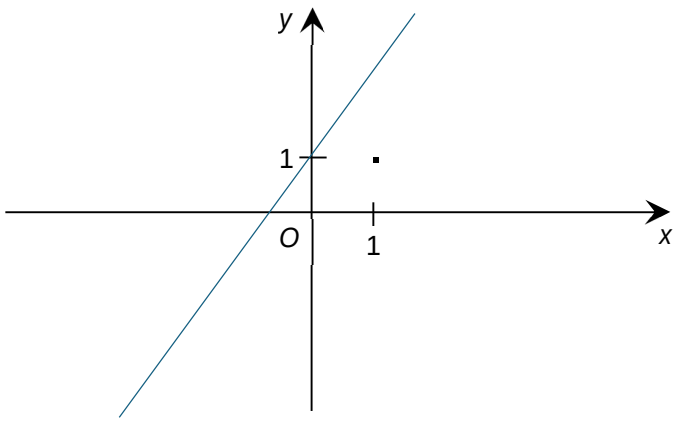
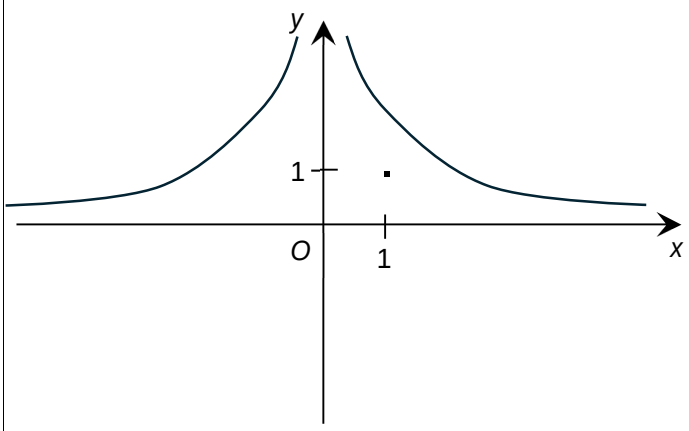
Sec 4 Exp/5 NA Prelim Paper 1 2024			
Q	**Solution**	**Marks**	**AO**
1	$p:16=3:20$ $\frac{p}{16}=\frac{3}{20}$ $p=\frac{3}{20}\times 16$ $=2.4 \text{ or } \frac{12}{5}$	B1	N3 AO1
2a	$2a^2c-ad-2abc+bd$ $=a(2ac-d)-b(2ac-d)$ $=(a-b)(2ac-d) \text{ or } (b-a)(d-2ac)$	B1, B1 / B2	N5 AO1
2b	$(7x-4y)(x+3y)$ $=7x^2+21xy-4xy-12y^2$ $=7x^2+17xy-12y^2$	M1 A1	N5 AO1
3	7, 7, 8, 15, 28	B1 – 7, 7, 8 B1 – 15, 28	S1 AO2
4a	$\angle CAB=\angle BAD \text{ (common angle)}$ $\angle ABC=\angle ADB \text{ (given)}$ Since 2 pairs of corresponding angles are equal, triangle ABC and ADB are similar. OR by AA *Similarity Test*	M1 – show two pairs of corresponding angles are equal AG1 – correct reason	G2 AO3
4b	$\frac{AC}{AB}=\frac{AB}{AD}$ $\frac{AC}{8}=\frac{8}{5}$ $AC=\frac{8}{5}\times 8$ $AC=12.8m \text{ or } 12\frac{4}{5}m \text{ o.e.}$	B1	G2 AO1
5	It may mislead readers thinking the number of EVs manufactured in 2023 is at least twice the number manufactured in 2022 based on the height or size of the picture.	B1 – Accept any similar answers on comparing size of the pictures	S1 AO3
6	$1cm:2000000cm$ $1cm:20km$ $1^2cm^2:20^2km^2$ $1cm^2:400km^2$ $400\times 0.55=220km^2$	M1 either 20^2 or 400 A1	N2 AO1

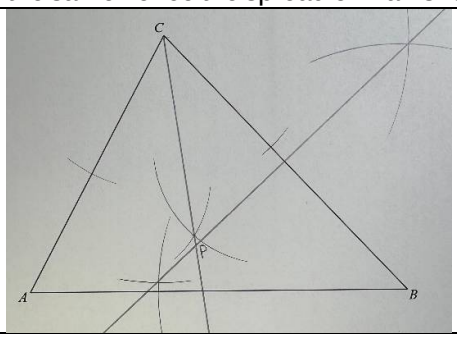
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Q	Solution	Marks	AO
7a	$4+7(n-1)$ or $7n-3$	B1	N5 AO1
7b	If 121 is a term, $7n-3=121$ $7n=124$ n= 17.714 (5sf) or $\frac{124}{7}$ or $17\frac{5}{7}$ o.e. Since n is **not a positive integer**, 121 is not a term	B1 with working of showing n = 17.714	N5 AO3
8	$F=\frac{k}{d^2}$ $k=Fd^2$ $new\,d=4.5d$ $new\,F=\frac{k}{(4.5d)^2}$ $new\,F=\frac{Fd^2}{20.25d^2}$ $new\,F=\frac{4}{81}F$ $\%\,change=\frac{\frac{4}{81}-1}{1}\times 100$ $=-\frac{7700}{81}\%$ or $-95\frac{5}{81}\%$ or $-95.1\%(3s.f)$	M1 – show $\frac{1}{20.25}$ or $\frac{4}{81}$ A1	N2 AO2
9a	n = any negative odd integer (-1, -3, -5 etc)	B1	N6 AO1
9bi		B1 – line must cut y = 1	N6 AO1

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Q	Solution	Marks	AO
9bii		M1 - The graph must be above (1,1).	N6 AO1
10	$newArea = 2.5 \times oldArea$ $oldArea = AB \times h$ $newArea = \frac{8}{10} AB \times \frac{100+x}{100} h$ $\frac{5}{2} \times oldArea = \frac{4}{5} AB \times \frac{100+x}{100} h$ $\frac{\frac{5}{2} \times oldArea}{oldArea} = \frac{\frac{4}{5} AB \times \frac{100+x}{100} h}{AB \times h}$ $\frac{5}{2} = \frac{4}{5} \times \frac{100+x}{100}$ $\frac{5}{2} = \frac{4(100+x)}{500}$ $\frac{2500}{2} = 4(100+x)$ $2500 = 8(100+x)$ $2500 = 800 + 8x$ $8x = 1700$ $x = 212.5\%$	M1 – form the equation for new Area A1	N3 AO2
11a	SD = 1.23 (3s.f.)	B2	S1 AO1

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Q	Solution	Marks	AO
11b	As all the marks are increased by 3 marks, the mean will also be increased by 3 marks but the standard deviation will remain the same hence the spread of marks remains unchanged.	B1	S1 AO3
12a, b		B1 – construction of perpendicular bisector B1 – construction of angle bisector	G1 AO1 AO1
12c	The point *P* is equidistant from the lines AC and BC and equidistant from the points B and C .	B1 – all correct	G1 AO1
13a	$54 = 2\times3^3$ $150 = 2\times3\times5^2$ $54\times150 = 2\times3^3\times2\times3\times5^2$ $= 2^2\times3^4\times5^2$ $= \left(2\times3^2\times5\right)^2$ Since $54\times150 = \left(2\times3^2\times5\right)^2$, 54×150 is perfect square. *OR* Since the indices of all prime factors are multiples of 2 (or even), $2^2\times3^4\times5^2$ is a perfect square.	M1 – show prime factorised expression AG1	N1 AO3
13b	$150k = 2\times3\times5^2\times k$ $k = 2^2\times3^2\times5$ $k = 180$ the smallest possible integer $= 180$.	B1	N1 AO2
14a	$5x + y = 16y - x$ $5x + y = 4x + 5y - 3$ $16y - x = 4x + 5y - 3$	B1, B1 for forming any 2 equations	N7 AO2

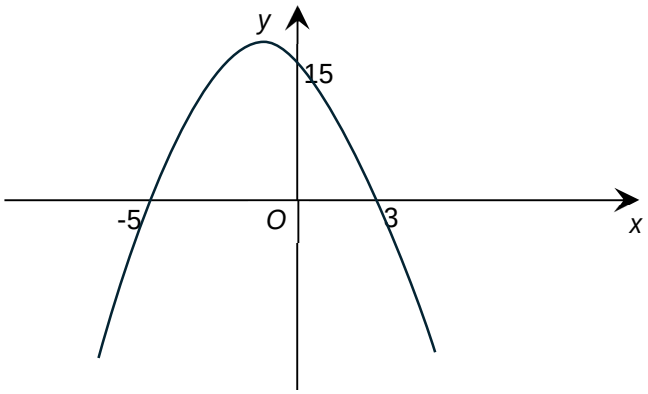
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Q	Solution	Marks	AO
14b	$5x + y = 16y - x$ $6x = 15y \quad -(1)$ $5x + y = 4x + 5y - 3$ $x = 4y - 3 \quad -(2)$ sub (2) into (1) $6(4y - 3) = 15y$ $24y - 18 = 15y$ $9y = 18$ $y = 2$ Sub y = 2 into (2) $x = 4(2) - 3$ $x = 5$ $\therefore x = 5,\ y = 2$ $AC = 4(5) + 5(2) - 3$ $= 27cm$ Perpendicular ht from B to $AC = \sqrt{27^2 - \left(\frac{27}{2}\right)^2}$ $= 23.382cm$ $Area\ of\ ABC = \frac{1}{2} \times 27 \times 23.382$ $= 315.657$ $= 316cm^2\ (3sf)$ OR $\angle ABC = 60°\ (angles\ of\ an\ equilateral\ \Delta)$ $Area\ of\ ABC = \frac{1}{2} \times 27 \times 27 \times \sin 60°$ $= 315.666$ $= 316cm^2\ (3sf)$	M1 - Using Substitution or Elimination method A1, A1 A1 A1	N7 AO2

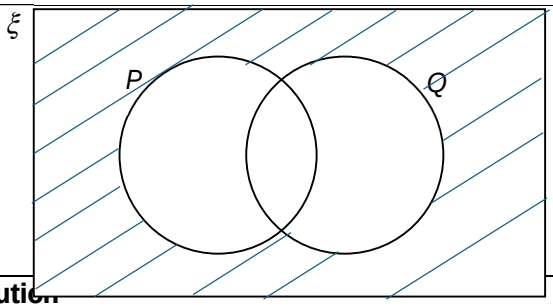
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Q	Solution	Marks	AO
15a	$\frac{4^{\frac{1}{2}}}{16^{y+1}} = 8^{2-y}$ $\frac{2}{2^{4(y+1)}} = 2^{3(2-y)}$ $\frac{2}{2^{4y+4}} = 2^{6-3y}$ $2^{1-(4y+4)} = 2^{6-3y}$ $1-(4y+4) = 6-3y$ $1-4y-4 = 6-3y$ $1-4-6 = y$ $y = -9$	M1 - $(4^{\frac{1}{2}} = 2)$ or $2^{4(y+1)}$ or $2^{3(2-y)}$ or $2^{1-(4y+4)}$ M1 - $1-4y-4 = 6-3y$ A1	N1 AO1
15b	2^{500} $= (2^2)^{250}$ $= 4^{250}$ $4^{250} < 5^{250}$ I disagree with her claim because $4^{250} < 5^{250}$.	M1 - $(2^2)^{250}$ or 4^{250} AG1 – must state $4^{250} < 5^{250}$ o.e.	N1 AO3
16a	$5:7$	B1	G2 AO1
16b	$\frac{Mass\ of\ X}{Mass\ of\ C} = \frac{5^3}{7^3}$ $\frac{Mass\ of\ X}{36} = \frac{125}{343}$ $Mass\ of\ X = \frac{125}{343} \times 36$ $= \frac{4500}{343} kg$ $mass\ of\ Y = 36 - \frac{4500}{343}$ $= 22.8804$ $= 22.9kg(3sf)$	M1 – finding $\frac{5^3}{7^3}$ A1	G2 AO2

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Q	Solution	Marks	AO
17ai	$x^2-12x+5=x^2-12x+\left(\frac{-12}{2}\right)^2-\left(\frac{-12}{2}\right)^2+5$ $=\left(x^2-12x+36\right)-36+5$ $=(x-6)^2-31$ $a=6,\ b=-31$	B1, B1	N7 AO1
17aii	$x=6$	B1	N7 AO1
17bi		B1 – correct shape of grph B1 – x and y intercepts shown	N6 AO1
17bii	$(-1,16)$	B1	N6 AO1
18a	$Q(3,0)$	B1	G6 AO2
18b	$\frac{0-4}{3-(-3)}$ $=\frac{-4}{6}$ $=-\frac{2}{3}$ $\frac{6-4}{x-(-3)}=-\frac{2}{3}$ $\frac{2}{x+3}=-\frac{2}{3}$ $x+3=-3$ $x=-6$	M1 – finding gradient A1	G6 AO2
Q	**Solution**	**Marks**	**AO**

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18c	$m=-\frac{2}{3}$ $y=-\frac{2}{3}x+c$ $Sub\,(-3,4)$ $4=-\frac{2}{3}(-3)+c$ $4-2=c$ $c=2$ $y=-\frac{2}{3}x+2$ *o.e.*	B1	G6 AO1
19ai	$(2\pi-1.8)rad$	B1	G5 AO1
19aii	$(2\pi-1.8)\times 5=(10\pi-9)cm$	B1	G5 AO1
19b	$Area\,\text{sec}\,tor\,OADB=\frac{1}{2}\times 5^2\times 1.8$ $=22.5cm^2$ $Area\,of\ \Delta AOB=\frac{1}{2}\times 5\times 5\times \sin 1.8rad$ $=12.173cm^2\ (5s.f.)$ $Area\,of\ shaded\,\text{se}\,gment=22.5cm^2-12.173cm^2$ $=10.327cm^2$ $=10.3(3sf)cm^2$	M1 M1 A1	G5 AO2
20ai	Integers that are perfect squares.	B1	N8 AO1
20aii	{1,9}	B1	N8 AO1
20aiii	11	B1	N8 AO1
20bi		B1	N8 AO1
Q	**Solution**	**Marks**	**AO**

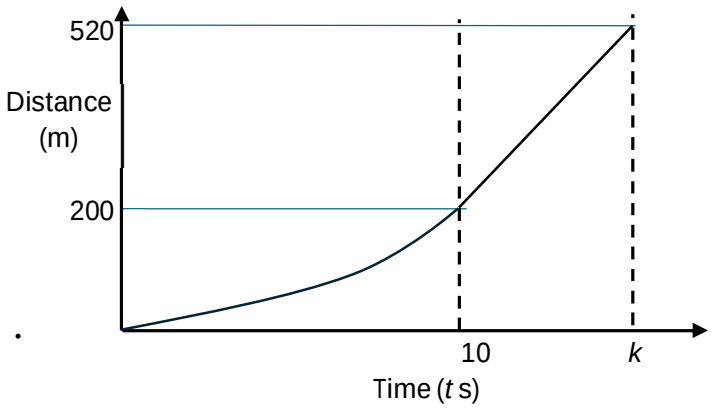
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20bii	$P' \cup Q$ *or* $(P \cap Q')'$ *or* $(P \cap Q) \cup (P \cap Q)'$	B1	N8 AO1
21ai	$AD^2 + DC^2 = 8^2 + 6^2$ $= 100$ $AC^2 = 10^2$ $= 100$ Since $AD^2 + DC^2 = AC^2$ *and* By the converse of Pythagoras' thereom, $\angle ADC = 90°$. OR Using Cosine rule, $\angle ADC = \cos^{-1}\left(\frac{10^2 - 8^2 - 6^2}{-2(8)(6)}\right)$ $= 90°$ (*Shown*)	M1 – show Pyth Thm AG1 M1 – show Cosine Rule AG1	G4 AO3
21aii	$\cos \angle ACB = -\frac{6}{10}$ $= -\frac{3}{5}$	B1 – lowest term	G4 AO1
21b	$\sin x° = 0.8929$ $x = \sin^{-1} 0.8829$ $x = 63.239$ *or* $180 - 63.239$ $x = 63.2$ *or* $116.8 (1dp)$	B1 B1	G4 AO1
22ai	$\angle BAE = \frac{(5-2)180}{5}$ $= 108°$	B1	G1 AO1
22aii	$\angle AEB = \frac{180 - 108}{2}$ (*base* $\angle s$ *of isos.* Δ) $= 36°$	B1	G1 AO1
22aiii	ΔAEB are congruent to ΔDEC. $\angle BEC = \angle BAE - \angle AEB - \angle DEC$ $\angle BEC = 108 - 36 - 36$ $= 36°$	B1	G1 AO2

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22b	$\text{Since } \angle ECD = \frac{180-108}{2} = 36° \text{ (base } \angle \text{ of isosceles } \Delta),$ $\angle BEC = \angle ECD = 36°,$ *by the property of converse of alternate angles,* *BE is parallel to CD.* *OR* *They form a pair of alternate angles,* *BE is parallel to CD.*	B1 – converse of alternate angles	G1 AO3
23a	$p = 5$	B1	S1 AO1
23b	$LQ = 19$ $UQ = 27$ $IQR = 27 - 19 = 8$	M1, A1	S1 AO1
23c	x is any positive integer ≤ 22	B1	S1 AO1
24i	$\frac{44}{64} = \frac{11}{16}$	B1	S2 AO1
24ii	$\frac{20-x}{64-x} = \frac{3}{14}$ $14(20-x) = 3(64-x)$ $280 - 14x = 192 - 3x$ $11x = 88$ $x = 8$	M1 A1	S2 AO2
25a	$R = \begin{pmatrix} 30 & 30 & 35 \\ x & x+2 & 40 \end{pmatrix} \begin{pmatrix} 2.5 \\ 4 \\ 5.5 \end{pmatrix}$ $R = \begin{pmatrix} 387.5 \\ 2.5x + 4x + 8 + 220 \end{pmatrix}$ $R = \begin{pmatrix} 387.5 \\ 6.5x + 228 \end{pmatrix}$	 B1	N9 AO1
25b	The total amount of money collected from Outlet A selling the three types of drinks on a particular day.	B1	N9 AO3

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Q	Solution	Marks	AO
25c	$6.5x+228)-(387.5)=100.50$ $6.5x-159.5=100.5$ $6.5x=100.5+159.5$ $x=40$	B1	N9 AO2
25d	(1 1)	B1	N9 AO2
26a	$acceleration=\frac{40}{10}$ $=4ms^2$	B1	N10 AO1
26b	200 m	B1	N10 AO1
26c	$Area\,under\,graph$ = Area of triangle and area of rectangle $520=(\frac{1}{2}10\times 40)+(k-10)(40)$ $520=200+40k-400$ $40k=720$ $k=18$	B1	N10 AO1
26d		B1 – before t = 10, label of distance and smooth curve. B1 – after t = 10, label of distance and straight line.	N10 AO2

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