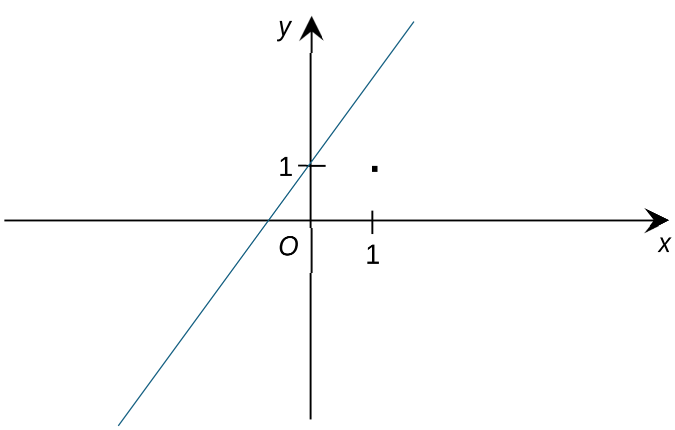
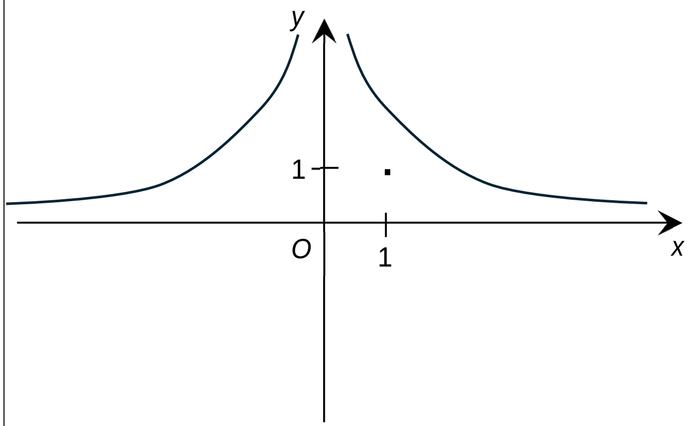
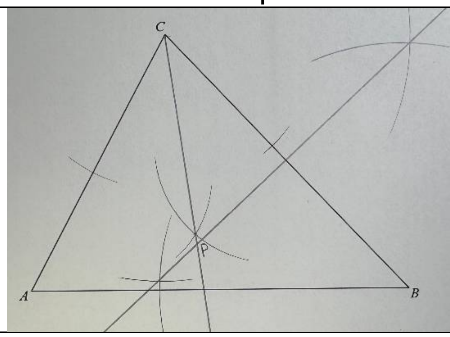
Sec 4 Exp/5 NA Prelim Paper 1 2024			
Q	**Solution**	**Marks**	**AO**
1	$p:16=3:20$ $\frac{p}{16}=\frac{3}{20}$ $p=\frac{3}{20}\times 16$ $=2.4\,or\,\frac{12}{5}$	B1	N3 AO1
2a	$2a^2c-ad-2abc+bd$ $=a(2ac-d)-b(2ac-d)$ $=(a-b)(2ac-d)\;\;or\;\;(b-a)(d-2ac)$	B1, B1 / B2	N5 AO1
2b	$(7x-4y)(x+3y)$ $=7x^2+21xy-4xy-12y^2$ $=7x^2+17xy-12y^2$	M1 A1	N5 AO1
3	7, 7, 8, 15, 28	B1 – 7, 7, 8 B1 – 15, 28	S1 AO2
4a	$\angle CAB=\angle BAD\,(common\,angle)$ $\angle ABC=\angle ADB\,(given)$ 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	$\frac{AC}{AB}=\frac{AB}{AD}$ $\frac{AC}{8}=\frac{8}{5}$ $AC=\frac{8}{5}\times 8$ $AC=12.8m\;or\;12\frac{4}{5}m\;o.e.$	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

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

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

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

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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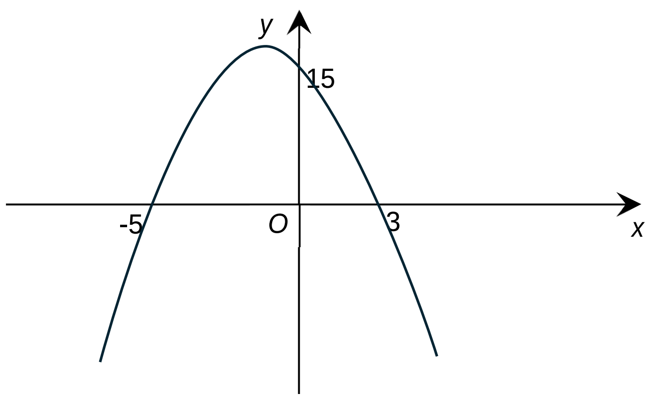
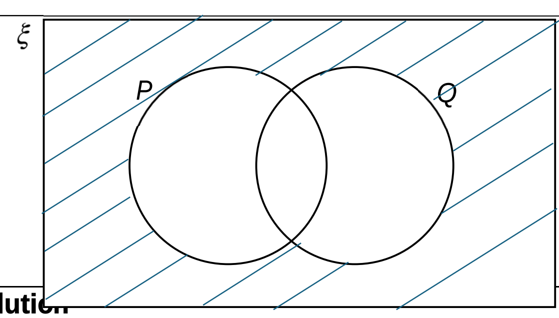
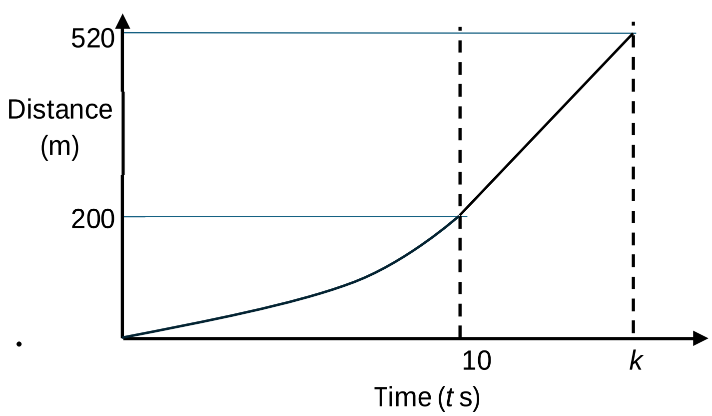
15a	$\frac{4^{\frac{1}{2}}}{16^{y+1}}=8^{2-y}$ $\frac{2}{2^{4(y+1)}}=2^{3(2-y)}$ $\frac{2}{2^{4y+4}}=2^{6-3y}$ $2^{1-(4y+4)}=2^{6-3y}$ $1-(4y+4)=6-3y$ $1-4y-4=6-3y$ $1-4-6=y$ $y=-9$	M1 - $(4^{\frac{1}{2}}=2)$ or $2^{4(y+1)}$ or $2^{3(2-y)}$ or $2^{1-(4y+4)}$ M1 - $1-4y-4=6-3y$ A1	N1 AO1
15b	2^{500} $=(2^2)^{250}$ $=4^{250}$ $4^{250}<5^{250}$ 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

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	$\left(-1,16\right)$	B1	N6 AO1
18a	$Q\left(3,0\right)$	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

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	$Area \sec tor\ OADB = \frac{1}{2} \times 5^2 \times 1.8$ $= 22.5 cm^2$ $Area\ of\ \Delta AOB = \frac{1}{2} \times 5 \times 5 \times \sin 1.8 rad$ $= 12.173 cm^2\ (5 s.f.)$ $Area\ of\ shaded\ \text{se}\,gment = 22.5 cm^2 - 12.173 cm^2$ $= 10.327 cm^2$ $= 10.3 (3sf) cm^2$	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**

20bii	$P'\cup Q \text{ or } \left(P\cap Q'\right)' \text{ or } \left(P\cap Q\right)\cup\left(P\cap Q\right)'$	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	$\sin x°=0.8929$ $x=\sin^{-1}0.8829$ $x=63.239 \text{ or } 180-63.239$ $x=63.2 \text{ or } 116.8(1dp)$	B1 B1	G4 AO1
22ai	$\angle BAE=\frac{(5-2)180}{5}$ $=108°$	B1	G1 AO1
22aii	$\angle AEB=\frac{180-108}{2}(base\ \angle s\ of\ isos.\Delta)$ $=36°$	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

22b	$\text{Since } \angle ECD = \frac{180-108}{2} = 36° \, (base \angle \, of \; isosceles \, \Delta)$, $\angle BEC = \angle ECD = 36°$, *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

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