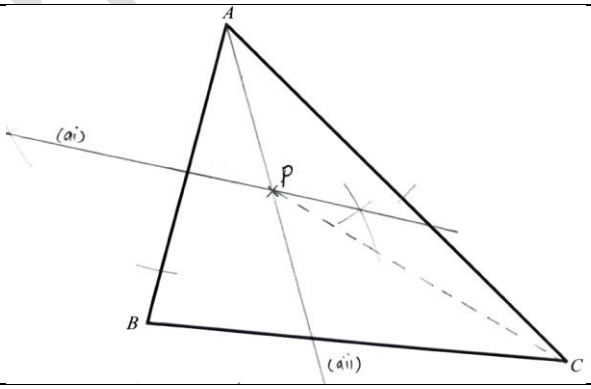
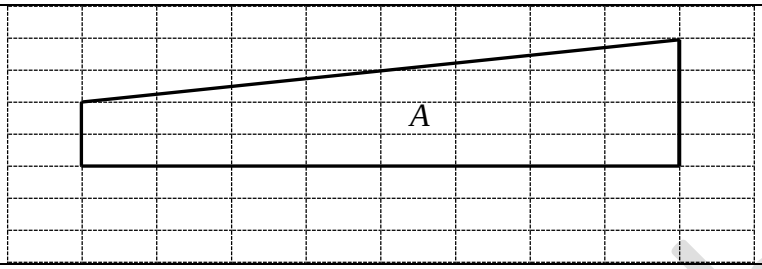
3NA EYE 2022 Marking Scheme & Marker's report

Qns	Suggested Workings	Marks	Remarks
1	$3.1\dot{4}$, π, 3.14, -3.142, $-\frac{22}{7}$	B2 – all 4 B1 – 3 correct	
2a	$792 = 2^3 \times 3^2 \times 11$	B1	
2b	$p = 2 \times 11$ $= 22$	B1	
3a	$x = \sqrt{\frac{125}{3}}$ $= 6.45$	B1	
3b	$x = \sqrt{\frac{y}{z}}$ $x^2 = \frac{y}{z}$ $z = \frac{y}{x^2}$	M1 A1	
4	$\text{interest} = 25000\left(1+\frac{3.6}{100}\right)^5 - 25000$ $= \$4835.88$ or $\$4840$	M1, M1 A1	M1 – correct value in formula M1- subtract 25000
5a	$\cos 152° = -\cos z°$ $z° = 180 - 152$ $= 28$	B1	
5b	$\frac{1}{2} \times 12.8 \times 8.2 \times \sin \angle XYZ = 36.736$ $\sin \angle XYZ = \frac{2(36.736)}{12.8(8.2)}$ $\angle XYZ = \sin^{-1}\left[\frac{2(36.736)}{12.8(8.2)}\right]$ or $180 - \sin^{-1}\left[\frac{2(36.736)}{12.8(8.2)}\right]$ $= 44.427$ or $180 - 44.427$ $= 44.4°$ or $135.6°$	M1 A1, A1	Need to put units for angle, else deduct 1 mark
6a	let total no. of balls be x $\frac{x-13-9}{x} = \frac{2}{13}$ $\frac{x-22}{x} = \frac{2}{13}$ $13(x-22) = 2x$ $11x = 286$ $x = 26$ [shown]	M1 A1	Need to show $11x = 286$

or	11 units ---------- blue + red 1 units ---------- $\frac{13+9}{11}$ 13 units ---------- 2×13 $=26$	M1 A1	Need to show 11 units (blue+red)
6b	$P(\text{not red})=\frac{26-9}{26}$ $=\frac{17}{26}$	 B1	
7a	123×10^{9} $=1.23\times10^{11}$	 B1	
7b	$\lambda=\frac{3\times10^{8}}{1.23\times10^{11}}$ $=0.0024390$ m =2.44 mm	 M1 A1	
8a	$3y-2x=9$ $y=\frac{2x+9}{3}$ $y=\frac{2}{3}x+3$ gradient $=\frac{2}{3}$	 M1 A1	Do not accept 3 s.f
8b	$(0,3)$	B1	
8c	Evidence: *LHS* : subs. $x=3$ and $y=-1$ into $3y-2x$ $3(-1)-2(3)=-9$ concept: $LHS \neq RHS$ Conclusion: $(2,-1)$ does not lies on the line *l*.	 M1 A1	 Need to explain LHS not equal to RHS
9ai, 9aii		ai: B1 aii: B1 – angle bisector B1 – point P	Need to show the construction lines No mark if never mark out P

9b	(7.8 ± 0.1) cm	ecf. B1	
10	interior angle of polygon $A = 90°$ $B = 180 - \frac{360}{5}$ $= 108°$ $C = 360 - 90 - 108$ $= 162°$ ext. angle of polygon $C = 180 - 162$ $= 18°$ no. of sides in polygon $C = \frac{360}{18}$ $= 20$	 M1 M1 M1 A1	 Find both *A* and *B* interior Find *C* interior Either using ext. or int. formula Use int. formula needs to show algebra manipulation
11	Evidence: $FD = (115 - 1.65)$ m $\tan \angle FED = \frac{FD}{GX}$ $\angle FED = \tan^{-1}\left(\frac{115 - 1.65}{125}\right)$ $= 42.2°$ Concept: $40° < 42.2°$ Conclusion: Since $40° < 42°$, Xing Qin claims is not correct. She is unable to see the top of the flag unless she tilted her head to at least 42.2°.	M1 M1 M1 A1	 Need to explain using the angle.
OR	Evidence: $\tan 40° = \frac{FD}{125}$ $FD = 125 \times \tan 40$ height of flag from ground $= 125 \times \tan 40 + 1.65$ $= 106.5$ m Concept: 106.5 m < 115 m Conclusion: Since 106.5 m < 115 m, Xing Qin claims is not correct. She could only see up to 106.5 m from the ground if she tilted her head to 40°.	 M1 M1 M1 A1	 Need to explain using the height of flag from ground.

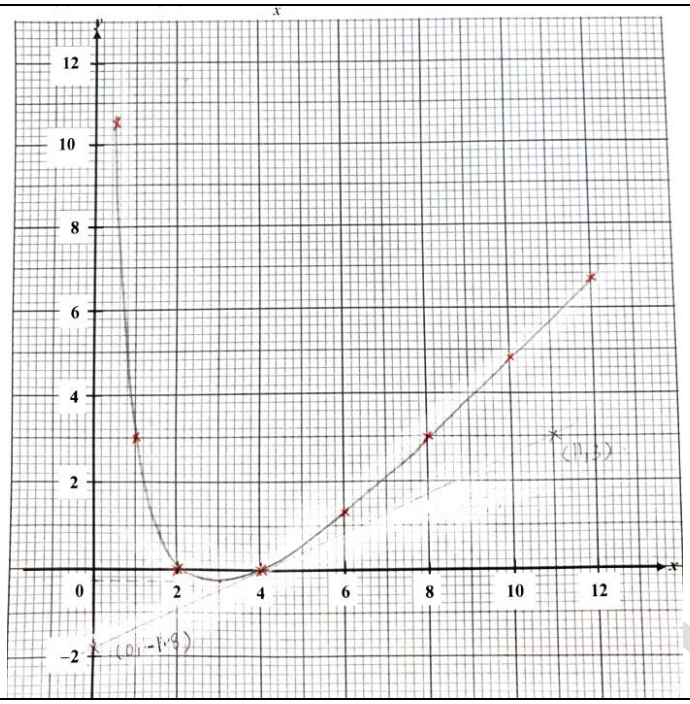
OR	Evidence: $FD = (115 - 1.65)$ m $= 113.35$ m tiling @ 40° $\tan 40° = \frac{FD}{125}$ $FD = 125 \times \tan 40$ $= 104.88$ Concept: 104.88 m ≠ 113.35 m Conclusion: Since 104.88 m ≠ 113.35 m, Xing Qin claims is not correct. The height of FD found by tiling at 40° is not same as 113.35.	M1 M1 M1 A1	Need to explain using citing the FD found are not same
12a	$AC^2 = 8^2 + 5^2 - 2(8)(5)\cos 60°$ $AC = \sqrt{8^2 + 5^2 - 2(8)(5)\cos 60°}$ $= 7$ m	M1 A1 /B2	
12b	$\frac{\sin \angle ACD}{4} = \frac{\sin \angle 110}{7}$ $\angle ACD = \sin^{-1}\left(\frac{\sin \angle 110}{7} \times 4\right)$ $= 32.5°$	M1 A1	Need to put units for angle, else deduct 1 mark
13a	difference $= \frac{23 - 47}{4}$ $= -6$ $a = 47 - 6$ $= 41$ $b = 41 - 6$ $= 35$ $c = 35 - 6$ $= 29$	M1 for finding difference A1	
13b	$53 - 6n$ or $47 - 6(n-1)$	B1	

13c	Evidence: $53-6n=-123$ $n=29.3$ Concept: $29.3\neq$ positive integer Conclusion: Since n is not a positive integer, -123 is not in the sequence.	M1 A1	
14a		B2 – all 4 sides -1 for 1 side wrong	
14b	$\frac{5}{n+4}=\frac{2}{n-2}$ $5(n-2)=2(n+4)$ $3n=8+10$ $n=6$ $PQ=10$ cm	M1 M1 A1	
15a	$\frac{AC}{AB}=\frac{2}{5}$ $AC:CB$ $2:3$	 B1	
15b	2 units ---------- 25 cm 1 unit ---------- $\frac{25}{2}$ 5 unit ---------- $\frac{25}{2}\times 5$ $AB=62.5$ cm		
15bi	$4:100000$ $1:25000$	 B1	
15bii	4 cm : 1 km 4^2 cm^2 : 1 km^2 1 cm^2 ---------- $\frac{1}{16}$ 250 cm^2 ---------- $\frac{1}{16}\times 250$ $=15.625$ km^2	 M1 A1	

16a	$x = \frac{800-700}{800} \times 100\%$ $x\% = 12.5$	 B1	Need to show % in working
16b	$\text{red} = \frac{2}{5}$ of 25% $= 10\%$ $\text{green} = 15\%$ $15\% ------- 45$ $1\% ------- \frac{45}{15}$ $100\% ------ \frac{45}{15} \times 100$ $\text{total marbles} = 300$	M1 M1 A1	
17ai	$\angle XBZ = \angle BAC$ $= 31°$	 B1	No mark if never put degree
17aii	$BX = AB$ $BC = XZ$ $XC = BX - BC$ $= 5.7 - 3.2$ $= 2.5$ cm	 M1 A1	Either identify BX or BC
17b	Evidence: $\angle BXZ = \angle ABC$ (congruent property) Concept: $\angle BXZ = \angle ABC$ (converse of alt. angle) Conclusion: Since $\angle BXZ = \angle ABC$, by converse of alternate angle. XZ is parallel to AB.	 B1 B1	State congruent State alternate angle
OR	Evidence: $\angle XBZ = \angle BAC$ (congruent triangle) $\angle XBZ + \angle BXZ + \angle XZB$ $= 31° + 81° + 68°$ $=180°$ Concept: $\angle XBZ + \angle BXZ + \angle XZB = 180°$ (converse of sum of interior angles of parallel lines) Conclusion: Since $\angle XBZ + \angle BXZ + \angle XZB = 180°$, by converse sum of interior angles of parallel lines, XZ is parallel to AB.	 B1 B1	State congruent State sum of interior angles of parallel lines

18a	$\frac{3^4}{3^{2-3}}$ $=\frac{3^4}{3^{-1}}$ $=3^{4-(-1)}$ $=3^5$	 B1	
18b	$\left(\frac{8}{a^6}\right)^{\frac{2}{3}}$ $=\frac{4}{a^4}$	M1 A1	
18c	$8^{m+1}=32$ $2^{3(m+1)}=2^5$ $3(m+1)=5$ $3m+3=5$ $m=\frac{2}{3}$	M1 M1 A1	For convert to common base
19a	$x^2+6x-20$ $=(x+3)^2-20-3^2$ $=(x+3)^2-29$ $a=3$ $b=-29$	 M1 A1	
19b	$(x+3)^2-29=0$ $(x+3)^2=29$ $x+3=\pm\sqrt{29}$ $x=2.39$ or -8.39	 M1 A1	
19b	$5ax-10a-3x+6$ $=5a(x-2)-3(x-2)$ $=(x-2)(5a-3)$ dimension $=(x-2)$ cm by $(5a-3)$ cm or dimension $=(5a-3)$ cm by $(x-2)$ cm	 M1 M1 √A1	
20a	$2(2y+1)-3(3y-2)$ $=4y+2-9y+6$ $=-5y+8$	 M1 A1	

20bi	$\frac{2}{(x-2)^2}-\frac{3}{x-2}$ $=\frac{2}{(x-2)^2}-\frac{3(x-2)}{(x-2)^2}$ $=\frac{2-3(x-2)}{(x-2)^2}$ $=\frac{8-3x}{(x-2)^2}$	 M1 A1	
20bii	$\frac{8-3x}{(x-2)^2}=1$ $(x-2)^2=8-3x$ $x^2-4x+4=8-3x$ $x^2-x-4=0$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(1)(-4)}}{2(1)}$ $=\frac{1\pm\sqrt{17}}{2}$ $=2.56$ or -1.56	 √M1 √M1 A1	 Correct expansion Need to show $\frac{1\pm\sqrt{17}}{2}$
21a	$p=2+\frac{8}{2}-6$ $=0$ $q=6+\frac{8}{6}-6$ $=1.3$	 B1 B1	

21b		B1 for all correct points B1 for smooth curve	
21ci	$y = -0.2$ to -0.4 or	√B1	
21cii	$y = 2$ or 4	B1	
21d	$(0, -1.8)$ and $(11, 3)$ gradient $= \dfrac{3+1.8}{11}$ $= 0.436 \quad (0.3 \le m \le 0.7)$	 M1 A1	Need to show correct tangent line drawn
22a	diameter $= \dfrac{16.8}{6}$ or $\dfrac{5.6}{2}$ $= 2.8$ cm	 B1	
22b	vol. of empty space $= (16.8 \times 5.6 \times 3) - 12\left[\dfrac{4}{3}\pi\left(\dfrac{2.8}{2}\right)^3\right]$ $= 144.31$ $= 144$ cm^3	M1 A1	

22c	No. of repack boxes $= \frac{10 \times 12}{3}$ $= 40$	M1	no. of repack boxes
	Amt. spent on buying the chocolate and boxes $= 10 \times 12.5 + (0.95 \times 40)$ $= \$163$		
	$100\% - - - - - - - - - \$163$		find 125%
	$1\% - - - - - - - - - - \frac{163}{100}$	M1	
	$125\% - - - - - - - - - \frac{163}{100} \times 125$		
	Amt. for 25% profit $= \$203.75$		
	Selling price of each box $= \frac{\$203.75}{40}$ $= 5.093$	M1	find each selling price
	She needs to sell each box at at least \$6.	A1	

END OF PAPER