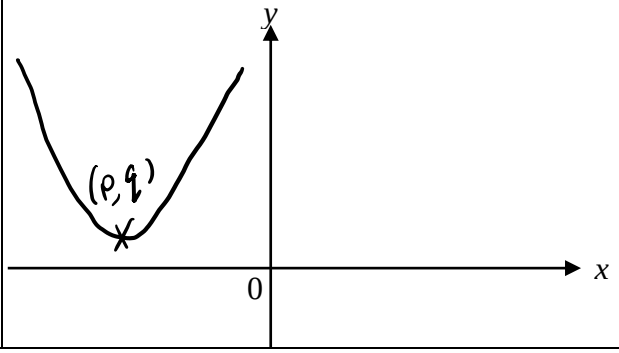
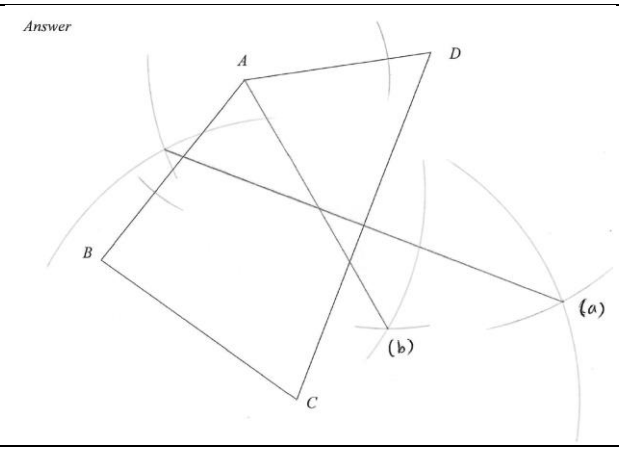
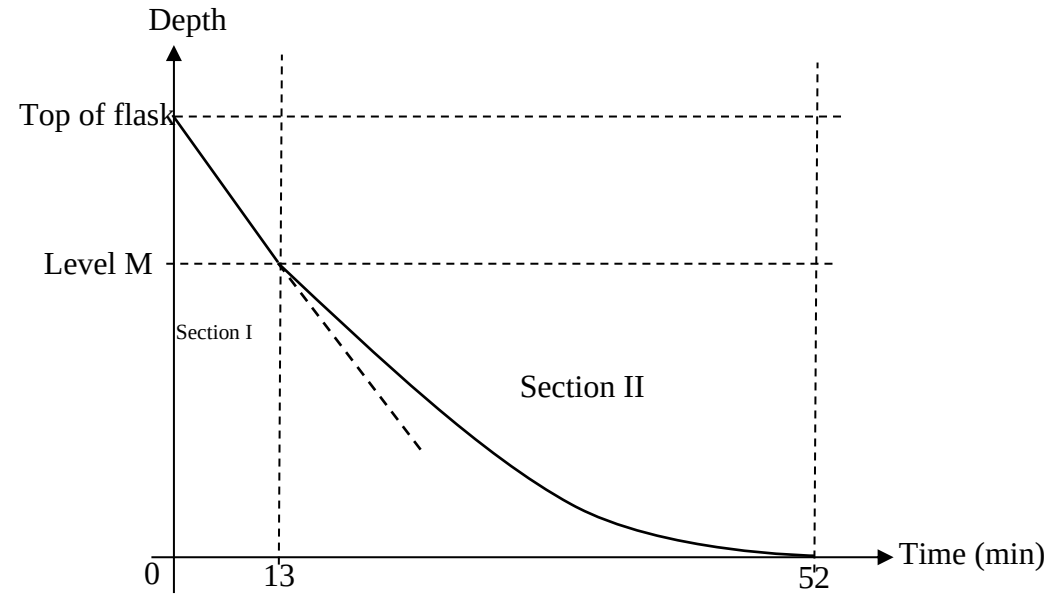
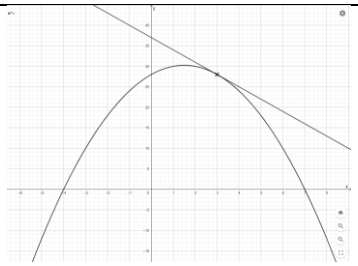
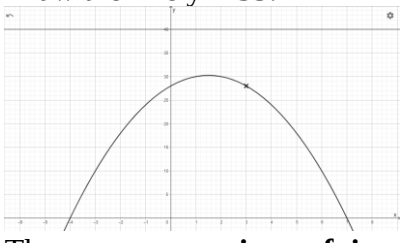
2022 4E5N E Math Prelim Paper 1 (Marking Scheme)

Qn	Solution	Remarks
1	69.5 g	
2	The inconsistent scale on the vertical axis exaggerates the differences in crude birth rate between the years. **OR** It is not clear whether the height or the area of the baby picture should be used to compare the crude birth rate. **OR** The area of each baby picture is not directly proportional to its height.	Do not accept 'size' of baby….. Do not accept the crude birth rate is proportional to the ……
3	$0.000\ 905\ 74 \div 10 \div 100 \times 2$ $= 0.000\ 00\ 181\ 148$ $= 1.81148 \times 10^{-6}$ m	Radius × 2 s.o.i Do **not** accept 1.81×10^{-6} m (3sf)
4	Distance travelled by wiper $= \frac{120}{360} \times 2 \times \pi \times 48 = 32\pi$/ 100.5309649 Speed $= \frac{32\pi}{0.8}$ $= 126\ cm/s\ (3sf)$	Find arc length Do not accept answers in terms of π
5	$L = kA^2$ $15 = k(3)^2$ $k = \frac{15}{9} = \frac{5}{3}$ → Hence $L = \frac{5}{3}A^2$	
6		Correct shape Correct position of turning point (p, q) where p<0 and q>0
7	Oliver's **78 marks is within top 25% of the class for the history test but below the top 25% of the class for the science test**. Hence, Oliver did better for the **history test**. **OR** Oliver's **78 marks is above the 75th percentile for the history test but below the 75th percentile of the class for the science test**. Hence, Oliver did better for the **history test**.	Comparing 78 with upper quartile of **both** tests No mark will be given for stating 'history test' if reason is wrong Do not accept upper interquartile range

8	Total amount paid $= \frac{18732}{100} \times 1.79$ = 335.1417 gallons 335.1417 x 3.785 = 1268.5113345 litres 1268.5113345 x 1.21 = USD 1535 (nearest dollar)	Total petrol consumption: $\frac{18732}{100} \times 1.79$ s.o.i Correct conversion between litres and gallons s.o.i
9(a)	$\frac{1115-1081}{1081} \times 100\% = 3.145\%$ (3dp)	
9(b)	Number of boys$= \frac{9}{9+16} \times 50 = 18$ boys After some girls join, 6 units represent 18 boys 1 unit represent $\frac{18}{6} = 3$ boys 19 units represent 3× 19 = 57 students New total = 57 students	
10(a)	Length = $\frac{100}{20} \times 38.2 = 191\ cm$	
10(b)	1 cm : 0.2 m → 1 cm^2 : 0.04 m^2 Actual area $= 0.04 \times 80 = 3.2$ m^2	area scale s.o.i
11(a)	$5832 = 2^3 \times 3^6$	
11(b)	The **powers of the prime factors** of 5832, 3 and 6, are **multiples of 3**. Hence, 5832 is a perfect cube. **OR** $5832 = 2^3 \times 3^6 = (\mathbf{2 \times 3^2})^{\mathbf{3}}$. Hence, 5832 is a perfect cube.	Do not accept 5832 has integer as a cube root (because does not use part (a))
11(c)	k = 2	
12(a)	9, 15, 21, 27	
12(b)	6n + 3= 3(2n + 1) **OR** **Both** 6n and 3 are multiples of 3. (Must mention specifically that 6n and 3)	Do not accept "the terms can be divided by 3" / Do not accept 6 is a multiple of 3.
13(a)	$3 - x < \frac{7-3x}{2} \leq 5$ $\Rightarrow 3 - x < \frac{7-3x}{2}$ and $\frac{7-3x}{2} \leq 5$ $6 - 2x < 7 - 3x$ $\quad 7 - 3x \leq 10$ $x < 1$ $\quad -3x \leq 3$ $x \geq -1$ $\therefore -1 \leq x < 1$	for $6 - 2x < 7 - 3x$ o.e. **OR** $7 - 3x \leq 10$ o.e
13(b)	– 1, 0	Allow ecf from (a)

14	Interior angle of polygon B at O $= 360° – 115° – 90° = 155°$ Exterior angle of polygon $B = 180° – 155° = 25°$ Number of sides of polygon $B = \frac{360°}{25°} = 14.4$ **OR** $\frac{(n-2)\times 180°}{n} = 155°$ $180n - 360 = 155n$ $25n = 360$ $n = 14.4$ Since **14.4 is not an integer**, polygon B cannot be a regular polygon.	Find interior angle of polygon B at O Find number of sides of polygon B (if regular) Explain 14.4 not an integer
15(a)(i)	$A = \{2,3,5,7,11,13,17,19\}$; $B = \{1,3,5,15\}$ $A \cap B = \{3,5\}$	Accept: 3, 5
15(a)(ii)	**(a)** $8 \notin$ A **(b)** $\{15\} \subset$ B	
15(b)	$P \cup Q'$	
16(a)	$\overrightarrow{RS} = \overrightarrow{OS} - \overrightarrow{OR} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$	
16(b)	$\lvert\overrightarrow{RS}\rvert = \sqrt{(1)^2 + (-3)^2} = 3.16$ units (3sf)	Allow ecf for answer in (a).
16(c)	$\overrightarrow{AB} = \begin{pmatrix} 0.8 \\ -2.4 \end{pmatrix} = 0.8 \begin{pmatrix} 1 \\ -3 \end{pmatrix} = 0.8\overrightarrow{RS}$	
17(a) **17(b)**	*Answer*  	Correct perpendicular bisector & angle bisector with construction arcs
17(c)	The playground is equidistant from the points **C** and **D** and equidistant from lines ***AB*** and ***AD***.	

18(a)	$\angle RSY$ $= 90° - \angle PSY$ (in square PQRS) $= \angle PST$ (in square STXY) (Shown)	90° - Ð*PSY*
18(b)	Ð*RSY* = Ð*PST* (Prove in (a)) Ð*YRS* = Ð*TPS* = 90° (Right angles of square *PQRS* and square *STXY*) *SY* = *ST* (sides of square *STXY*) D*RSY* congruent to D*PST* (AAS)	All 3 correct statements with reasons AND conclusion with congruence test stated.
19(a)	Reflex angle *AOC* = 360° – 153° = 207° Angle *ABC* = $\frac{207}{2}$ = **103.5°**	Finding reflex angle AOC s.o.i
19(b)	Angle OAW = 90° Angle OAB = 90° – 31° = 59° Angle BCO = 360° – 153° – 59° – 103.5° = 44.5°	Angle OAW = 90° s.o.i
20(a)	Acceleration = $\frac{93-60}{6} = 5.5\text{m/s}^2$	
20(b)	Let speed at t = 4s be *p* m/s $\frac{p-60}{4} = 5.5 \rightarrow p = 82\text{m/s}$	
20(c)	$\frac{1}{2} \times (93+v) \times (9-6) = 342$ *v* = 135	Any equivalent method of finding distance between *t* = 6s to *t* =9s
Qn	**Solution**	**Remarks**

21(a)		
21(b)	$\frac{\text{Height X}}{\text{Height Y}} = \sqrt[3]{\frac{960}{1875}} = \frac{4}{5}$ $\frac{\text{Base area X}}{\text{Base area Y}} = \left(\frac{4}{5}\right)^2$ $\frac{\text{Base area } X}{50} = \frac{16}{25}$ Base area of X = $\frac{16}{25} \times 50$ = 32 cm^2	Correct ratio of areas seen
22(a)	$x = 1.5$	
22(b)	 Gradient $= \frac{37-19}{0-6} = -3$	Draw tangent at (3,28) (accept – 2.6 to – 3.4 inclusive)
22(c)	Draw the line y = 35:  There are **no points of intersection** between the curve $y = -x^2 + 3x + 28$ and the line y = 35m. Hence, the height of the ball will never reach 35m	

23(a)(i)	$7q - 2(q + 3) = 7q - 2q - 6 = 5q - 6$	
23(a)(ii)	$\frac{xy^{-1}}{(2y^2)^3} = \frac{xy^{-1}}{8y^6} = \frac{x}{8y^7}$	Correct use of indices law $(ab)^m = a^m b^m$
23(b)	$\frac{7y}{(y-3)^2} - \frac{1}{3-y}$ $= \frac{7y}{(y-3)^2} + \frac{1}{y-3}$ $= \frac{7y + (y-3)}{(y-3)^2} = \frac{7y + y - 3}{(y-3)^2} = \frac{8y-3}{(y-3)^2}$	$\frac{8y-3}{(y-3)^2}$ **OR** $\frac{8y-3}{(3-y)^2}$
24(a)	$8y^2 + 20y - 12 = 4(2y^2 + 5y - 3) = 4(2y-1)(y+3)$	
24(b)	$x^3 + x^2 - 9x - 9$ $= x^2(x+1) - 9(x+1)$ $= (x+1)(x^2-9) = (x+1)(x+3)(x-3)$	
25(a)	$\frac{3x}{3x+4x} = \frac{3}{7}$	
25(b)	$\frac{3x-1}{7x-1}$	
25(c)	$\frac{3}{7}\left(\frac{3x-1}{7x-1}\right) = \frac{6}{35}$ $\frac{3x-1}{7x-1} = \frac{2}{5}$ $5(3x-1) = 2(7x-1)$ $15x - 5 = 14x - 2$ $x = 3$	