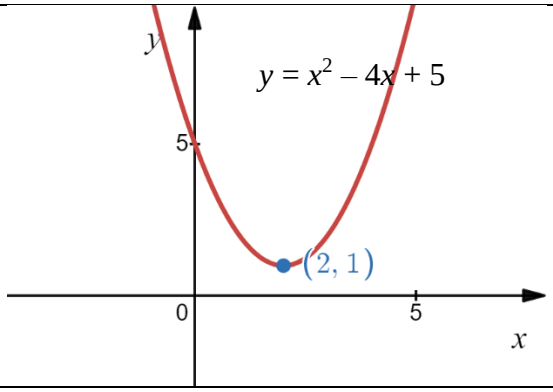
2024 GSS Sec 4E5N Mathematics Preliminary Examination Paper 1

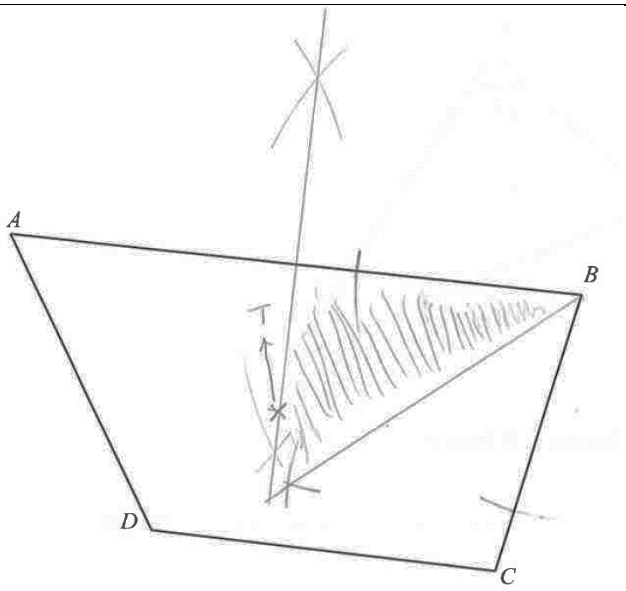
Item	Worked Solutions	Marks Awarded	Remarks
1(a)	9.52 (3 s.f.)	B1	Accept more exact answers.
1(b)	\$24.49	B1	
2(a)	$9^{12} = 27^x$ $(3^2)^{12} = (3^3)^x$ $3^{24} = 3^{3x}$ $24 = 3x$ $x = 8$	M1 A1	Express all in powers of 3.
2(b)	$6500 = 5000\left(1+\frac{p}{100}\right)^4$ $\left(1+\frac{p}{100}\right) = \sqrt[4]{\frac{6500}{5000}}$ $\frac{p}{100} = 0.06778997$ $p = 6.78\%$ (3 s.f.)	M1 A1	
3(a)	Brand *C*'s and Brand *D*'s sectors add up to 60% but is shown as half of the pie chart (which should be 50%). OR The total add up to 110% instead of 100%.	B1	
3(b)	Recalculate/Check the percentages for Brand *C* and Brand *D* so that the sectors of the pie chart should be proportional to the actual percentage.	B1	Accept "Recalculate all values to get the correct percentages."
4	$(2x + 1)(3x – 2)$	B2	M1 for multiplication frame or B1 for each correct factor
5	$\frac{2}{x-2}-\frac{3}{2x+1}$ $=\frac{2(2x+1)-3(x-2)}{(x-2)(2x+1)}$ $=\frac{4x+2-3x+6}{(x-2)(2x+1)}$ $=\frac{x+8}{(x-2)(2x+1)}$	M1 A1	M1 for combining fractions.
6	12,13,14, 16, 16, 19	B2	B1 for 14, 16, 16 in correct places. B1 for 12, 13, 19 in

			correct places.
7	$\frac{2x-3}{4} \le \frac{5-x}{5}$ $5(2x-3) \le 4(5-x)$ $10x-15 \le 20-4x$ $14x \le 35$ $x \le \frac{35}{14}$ $x \le 2.5$	M1 A1	M1 for multiplying 20 on both sides
8(a)	$\frac{\pi}{180} \times 40 = \frac{2}{9}\pi$ rad	B1	B1 for correct answer
8(b)	23 km/h $= \frac{23 \times 1000}{60 \times 60} = \frac{115}{18} = 6\frac{7}{18} = 6.39$ m/s	B1	B1 for correct answer
9	Total surface area $= \frac{1}{2} \times 4\pi(6)^2 + \pi(6)^2$ $= 72\pi + 36\pi$ $= 108\pi$ $= 339$ cm^2 (3 s.f.)	M1 A1	M1 for hemisphere + circle
10	$2c + b = \frac{b-c}{a}$ $2ac + ab = b - c$ $ab - b = -2ac - c$ $b(a-1) = -(2ac+c)$ $b = \frac{-(2ac+c)}{a-1}$ $b = \frac{2ac+c}{1-a}$	M1 M1 A1	M1 for cross-multiplication. M1 for isolating b. Accept answers with – sign in numerator.
11	$16^2 + 63^2 = 4225 = 65^2$ By the converse of Pythagoras' Theorem, triangle ABC is a right-angled triangle. A, B and C are also points on a circle by angle in a semicircle property. Yes, A, B and C lie on the circumference of a circle.	M1 A1 A1	M1 for showing P.T. A1 for P.T. A1 for circle property
12(a)	$ab^2(ab^2 - 1)$	B1	
12(b)	$(3x+2)^2 + 4x(2-x) = 9x^2 + 12x + 4 + 8x - 4x^2$ $= 5x^2 + 20x + 4$	M2 A1	M1 for $9x^2 + 12x + 4$ M1 for $8x - 4x^2$
13(a)	Area of hexagon $= 6 \times \frac{1}{2} \times 7 \times 7 \times \sin(60°)$	M1	

	$= 127.3057344 \text{ cm}^2$ $= 127 \text{ cm}^2$ (3 s.f.)	A1	
13(b)	$\frac{(15-2)\times 180}{15} = 156°$	B1	
14(a)	original $y = k\sqrt[3]{x}$ new $y = k\sqrt[3]{8x} = 2k\sqrt[3]{x}$ Percentage change $= \frac{2k\sqrt[3]{x} - k\sqrt[3]{x}}{k\sqrt[3]{x}} \times 100$ $= 100\%$	M1 A1	
14(b)	6 men takes 50 hours to paint a mural. 4 men takes $\frac{6}{4} \times 50 = 75$ hours to paint the same mural.	M1 A1	
15(a)	P(yellow) = $\frac{1-0.2-0.1}{2} = 0.35$ (shown)	B1	
15(b)	Total number of counters $= \frac{1}{0.35} \times 14$ $= 40$	M1 A1	
15(c)	P(yellow) = $\frac{14}{40-3} = \frac{14}{37}$	B1	
16	Reflex Angle $AOC = 100 \times 2 = 200°$ (Angle at centre is twice the angle at circumference) Obtuse angle $AOC = 360° - 200 = 160°$ (Angles at a point) Angle $OAC = \frac{180° - 160°}{2} = 10°$ (Angles of an isosceles triangle OAC)	M1 M1 M1 A1	M1 awarded with correct reasoning
17(a)	$2+4(n-1) = 4n-2$	B1	
17(b)	$4n - 2 = 82$ $4n = 84$ $n = 21$	B1	
17(c)	If $4n - 2 = 360$, $n = 90.5$ which is not an integer, so 360 is not a term in the sequence.	B1	
17(d)	8th term $= [-4(8)^2 + 54(8)] - [-4(7)^2 + 54(7)]$ $= 176 - 182$ $= -6$	M1 A1	M1 for subtraction

18(a)	$x^2 - 4x + 5 = (x-2)^2 + 1$ $a = 2$ $b = 1$	 B1 B1	
18(b)	$x = 2$	B1	
18(c)		 B1 B1 B1	 Correct shape Correct turning point Correct *y*-intercept
19	$5x + 2y = 111 - -(2)$ $x + y = 30 - -(1)$ $(2) - 2\times(1):$ $3x = 51$ $x = 17$ Sub into $(1):$ $y = 13$ Amount of money Siti has = $17 \times 5 = \$85$	B1 B1 M1 A1	Forming correct equations. Solving.
20(a)	7.75	B1	
20(b)	4.18 (3 s.f.)	B1	
20(c)	The mean would be increased by 3. The standard deviation will remain the same.	B1 B1	
21(a)	$2^2 \times 5^3 \times 11$	B1	
21(b)	$p = 2$ $q = 11$	B1 B1	
21(c)	LCM of 50, 60 and 75 = 300 min = 5 hours They will meet again at 11 am.	M1 A1	M1 for LCM
22(a)	Bearing of *B* from *A* = 180 + 040 = 220°	 M1 A1	
22(b)	Bearing of *C* from *A* = 180 – (65 – 040) = 155°	 M1 A1	

23(a)	$\begin{pmatrix} 1100 & 1000 & 1200 \\ 1400 & 1200 & 1300 \end{pmatrix}$	B1	
23(b)	$\begin{pmatrix} 110 \\ 80 \\ x \end{pmatrix}$	B1	
23(c)	$\begin{pmatrix} 1100 & 1000 & 1200 \\ 1400 & 1200 & 1300 \end{pmatrix}\begin{pmatrix} 110 \\ 80 \\ x \end{pmatrix}$ $= \begin{pmatrix} 201000+1200x \\ 250000+1300x \end{pmatrix}$	M1 A1	
23(d)	The elements represent the amount of ticket sales for each day (Saturday, Sunday).	B1	
23(e)	$201000+1200x+250000+1300x=688500$ $2500x=323000$ $2500x=237500$ $x=95$	M1 A1	
24(a)	Area of triangle ABC $= 0.5 \times 4 \times 7$ $= 14$ unit^2	B1	
24(b)	(6, 6)	B1	
24(c)	Area of parallelogram = $14 \times 2 = 28$ unit^2	B1	
24(d)	Angle $BAC = \tan^{-1}\left(\frac{4}{8}\right)$ $= 26.6°$ (1 d.p.)	B1	
24(e)	undefined	B1	
24(f)	$-\frac{1}{p}$	B1	Using cosine rule to get $\frac{p^2-31}{14p}$ also accepted.

25(a)		B1	Bisector constructed accurately with construction arcs
25(b)		B1	Perpendicular bisector constructed accurately with construction arcs on both sides of *AB*
25(c)		B1	Correct region shaded
25(d)		B1	Correct position of *T*