

JURONG SECONDARY SCHOOL
2022 GRADUATION EXAMINATION 2
SECONDARY 4 EXPRESS/
SECONDARY 5 NORMAL ACADEMIC

CANDIDATE NAME	MARKING SCHEME
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CLASS	
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INDEX NUMBER	
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MATHEMATICS

4048/02

PAPER 2

24 August 2022
2 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

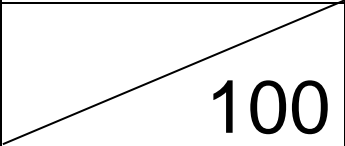
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 100.

For Examiner's Use
 100

1	(a)	(i)	$\frac{3}{2}$	B1
		(ii)	$y = \frac{5x-2}{3x+1}$ $3xy + y = 5x - 2$ $5x - 3xy = y + 2$ $x(5 - 3y) = y + 2$ $x = \frac{y+2}{5-3y}$	M1 – simplify + group A1
	(b)		$\frac{x-5}{3} - \frac{x+3}{2} = -4$ $\frac{2(x-5) - 3(x+3)}{6} = -4$ $2x - 10 - 3x - 9 = -24$ $x = 5$	M1 – same denominator A1
	(c)		$2x + y = 23$ $y = 23 - 2x$ $3x - 2(23 - 2x) = 10$ $3x - 46 + 4x = 10$ $7x = 56$ $x = 8$ $y = 7$	M1 – substitution A1 A1
	(d)		$\frac{4x^2 - 9}{6x^2 - x - 12}$ $= \frac{(2x-3)(2x+3)}{(2x-3)(3x+4)}$ $= \frac{2x+3}{3x+4}$	M1 – numerator M1 – denominator A1
				Total: 11 marks

2	(a)	$\begin{pmatrix} 28 & 24 \\ 16 & 12 \end{pmatrix}$	B1
	(b)	$\begin{pmatrix} 70 \\ 80 \end{pmatrix}$	B1
	(c)	$\begin{pmatrix} 3880 \\ 2080 \end{pmatrix}$	B1
	(d)	The elements represent the total amount Mrs Teo collected in a month from the weekday and weekend sessions respectively.	B1
	(e)	<p>Total amount of money per session $= \begin{pmatrix} 10 & 8 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 70 \\ 80 \end{pmatrix} = \begin{pmatrix} 1340 \\ 370 \end{pmatrix}$</p> <p>Total after 10% increase $= \begin{pmatrix} 1 & 1.1 \end{pmatrix} \begin{pmatrix} 1340 \\ 370 \end{pmatrix} = (1747)$</p> <p>$1747 \times 4 \times 3 = \\20964</p>	<p>M1</p> <p>M1</p> <p>M1 A1</p> <p>Accept non-matrices working</p>
			Total: 8 marks

3	(a)	$\angle XCD = \frac{360^\circ}{18} = 20^\circ$	B1
	(b)	$\angle XCD = \angle XDC$ $\angle CXD = 180^\circ - 20^\circ - 20^\circ$ (isos. Δ) $= 140^\circ$	A1 (with reason)
	(c)	$BC = ED$ (sides of regular polygon) $XC = XD$ (given) $\therefore BC + CX = ED + DX$ $BX = EX$	M1 – evidence A1
	(d)	$\angle BXE = \angle CXD$ (common) $\angle XBE = \frac{180^\circ - 140^\circ}{2} = 20^\circ$ $\therefore \angle XCD = \angle XBE$ ΔXCD and ΔXBE are similar (AA)	M1 – evidence A1
	(e)	They are parallel.	B1
			Total: 7 marks

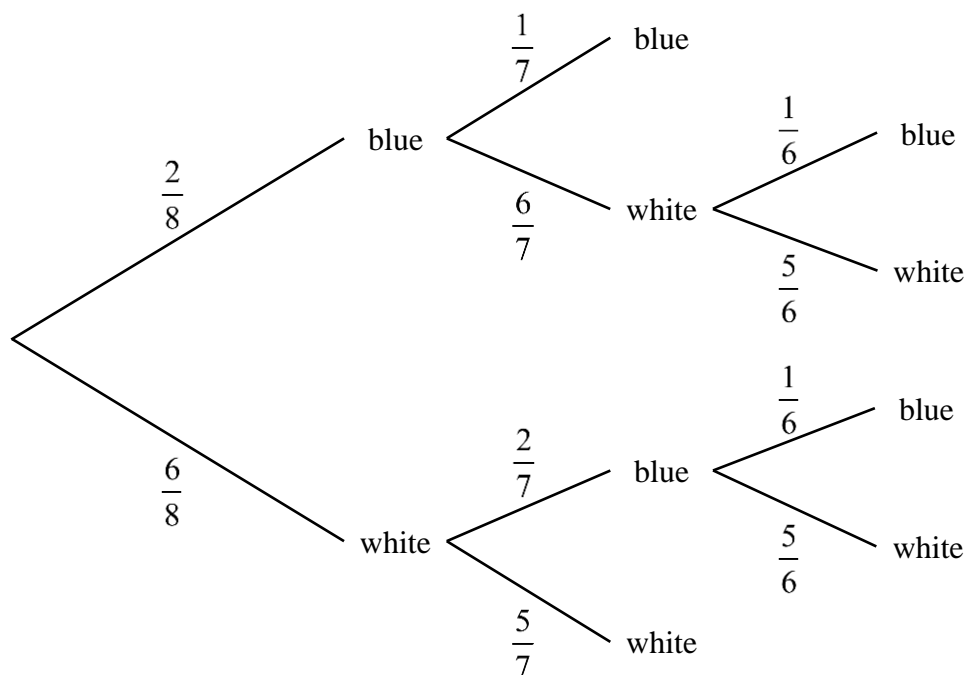
4	(a)	$T_5 = 9^2 - 34 = 47$	B1 (with working)
	(b)	$T_n = (n+4)^2 - 18 - 4(n-1)$ $= n^2 + 8n + 16 - 18 - 4n + 4$ $= n^2 + 4n + 2$	M1 – $n+4$ and $18+4(n-1)$ A1
	(c)	$n^2 + 4n + 2 = 962$ $n^2 + 4n - 960 = 0$ $n = \frac{-4 \pm \sqrt{4^2 - 4(1)(-960)}}{2(1)}$ $= 29.048 \text{ or } -33.048$ Since n is not an integer, 962 is not a term of the sequence.	M1 – find value of n A1
	(d)	$T_n - T_{n-1}$ $= (n^2 + 4n + 2) - [(n-1)^2 + 4(n-1) + 2]$ $= n^2 + 4n + 2 - (n^2 - 2n + 1 + 4n - 4 + 2)$ $= n^2 + 4n + 2 - n^2 + 2n - 1 - 4n + 4 - 2$ $= 2n + 3$	M1 – correct expression M1 – correct expansion A1
	(e)	The difference between two consecutive terms is $2n + 3$. Since $2n$ is always even for all values of n , the sum of an even integer and an odd constant 3 will always give an odd integer.	B1 – always even + add to odd
			Total: 8 marks

5	(a)	$p = 2.2$		B1
	(b)	Refer to last page		G3
	(c)	The graph of $y = x + \frac{5}{x^2} - 3$ does not meet the line $y = 0$ /does not have any x -intercepts/ the minimum y -value is , which is more than 0		B1
	(d)	Draw tangent Gradient = -1.96 ± 0.7		B1 B1
	(e)	(i)	Draw line with gradient 2 passing through (0.5, 2) (y-intercept = 1)	B1 - passes through (0.5, 2) B1 – correct gradient (& y-int)
		(ii)	$y = 2x + 1$	B1
		(iii)	$x + \frac{5}{x^2} - 3 = 2x + 1$ $\frac{5}{x^2} = x + 4$ $5 = x^3 + 4x^2$ $x^3 + 4x^2 - 5 = 0$	M1 – sim. eqn. A1 – final eqn
		(iv)	$x = 1$	B1 (ecf – accept answer from intersection of curve and line)
				Total: 13 marks

6	(a)	$OS = OR$ (radii of smaller circle) $\angle POS = \angle QOR$ (vert. opp. \angle) $OP = OQ$ (radii of larger circle) $\therefore \triangle PSO$ is congruent to $\triangle QRO$ (SAS) Alternatives: RHS, AAS	M1 A1
	(b)	(i) $\angle ORQ = 90^\circ$ (tan \perp rad) $QR = \sqrt{8^2 - 4.36^2}$ $= 6.7075$ Area of $\triangle QRO = \frac{1}{2}(4.36)(6.7075)$ $= 14.62235$ $\approx 14.6 \text{ cm}^2$	M1 – with evidence M1 A1
		(ii) Area of shaded minor sector $= \frac{1}{2}(4.36)^2(0.995)$ $= 9.457276$ Area of ring between the circles $= \pi(8)^2 - \pi(4.36)^2$ $= 141.3415$ Area of unshaded in $\triangle QRO$ $= 14.62235 - 9.457276$ $= 5.165074$ Shaded area $= 141.3415 + 2(9.457276) - 2(5.165074)$ $= 149.925904$ $\approx 150 \text{ cm}^2$	M1 M1 M1 A1
			Total: 9 marks

7	(a)		$\frac{5}{1+2+4+5} \times 300 \times \$148 = \$18500$	M1 A1
	(b)	(i)	$\frac{300}{x} \text{ min}$	B1
		(ii)	$\frac{300}{x-2} \text{ min}$	B1
		(iii)	$\frac{300}{x-2} - \frac{300}{x} = 3$ $\frac{300x - 300(x-2)}{x(x-2)} = 3$ $x^2 - 2x - 200 = 0 \text{ (shown)}$	M1 – form eqn M1 – combine fractions A1
		(iv)	$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-200)}}{2(1)}$ $= 15.17744 \text{ or } -13.17744$ $\approx 15.2 \text{ or } -13.2$	M1 A1 (3sf, no rej.)
		(v)	Reject -13.2 $x = 15.2$ $15.17744 \times 60 = 910.6464$ ≈ 910	M1 A1 (round down) (Reject 3 x 60)
				Total: 11 marks

8	(a)	$\angle AOB = 120^\circ, \angle ABO = 30^\circ$ $\frac{OA}{\sin 30^\circ} = \frac{8}{\sin 120^\circ}$ $OA = \frac{8}{\sin 120^\circ} \times \sin 30^\circ$ $\approx 4.6188 \text{ cm}$ $= 4.619 \text{ cm} \quad (\text{to } 3 \text{ d.p.})$ OR $OA = \frac{2}{3} \sqrt{8^2 - 4^2}$ $= 4.61880$ ≈ 4.619	M1 – sine rule A1 M1 A1
	(b)	Base area $\triangle ABC = \frac{1}{2}(8)(8)\sin 60^\circ$ $\approx 27.7128 \text{ cm}^2$ Height of $\triangle AXB$, $l = \sqrt{18^2 - 4^2}$ $\approx 17.5499 \text{ cm}$ Total surface area $= 3 \times \frac{1}{2}(8)(17.5499) + 27.7128$ $\approx 238.31 \text{ cm}^2$ $= 238 \text{ cm}^2 \text{ (to } 3 \text{ s.f.)}$	M1 – base M1 – lateral height A1
	(c)	$\cos \angle PQR = \frac{5^2 + 4^2 - 3.5^2}{2(5)(4)}$ $\angle PQR = \cos^{-1}\left(\frac{23}{32}\right)$ $= 44.0^\circ \text{ (to } 1 \text{ d.p.)}$	M1 – cosine rule A1
	(d)	$AQ = 6 \text{ cm}$ $OQ = \sqrt{4.619^2 + 6^2 - 2(4.619)(6)\cos 30^\circ}$ $\approx 3.055 \text{ cm}$ $XO = \sqrt{18^2 - 4.619^2}$ $\approx 17.397 \text{ cm}$ $\tan \theta = \frac{17.397}{3.055}$ Angle of elevation of X from Q $= \tan^{-1}\left(\frac{17.397}{3.055}\right)$ $= 80.0^\circ \text{ (to } 1 \text{ d.p.)}$	M1 – find OQ M1 – Pythagoras' thm M1 A1
			Total: 11 marks

9	(a)	(i)	$100 < x \leq 120$		B1	
		(ii)	22%		B1	
		(iii)	$\text{S.D.} = \sqrt{\frac{809000}{50} - \left(\frac{6280}{50}\right)^2}$ $= 20.11566$ ≈ 20.1		M1 – working (show substitution) A1	
		(iv)	The blood pressures of the second group of patients is less consistent than that of the first group of patients, since it has a SD of 22.1 which is higher than the SD of the first group (20.1)		B1 – compare SD and comment on consistency	
	(bi)					B2 -1 for each wrong pair of branches
		(ii)	(a)	$\left(\frac{6}{8} \times \frac{5}{7}\right) + \left(\frac{2}{8} \times \frac{1}{7}\right) = \frac{4}{7}$	M1 – either both W or both B A1 FT from tree diagram	
			(b)	$\left(\frac{2}{8} \times \frac{6}{7} \times \frac{1}{6}\right) + \left(\frac{6}{8} \times \frac{2}{7} \times \frac{5}{6}\right)$ $= \frac{3}{14}$	M1 – either WBW or all BWB A1	
	Total: 11 marks					

10	(a)	$3.42 \times 2.7 = 9.234 \text{ m}^2$	B1 Reject 3s.f.
	(b)	<p>10 cm represents 168 cm 1 cm represent 16.8 cm Elbow to ground = 6.4 cm (accept 6.3cm and 6.5cm)</p> <p>$6.4 \times 16.8 = 107.52\text{cm}$</p> <p>Range of optimal kitchen cabinets height</p> <p>$107.52 - 10 = 97.52 \text{ cm to } 107.52 \text{ cm}$</p>	<p>M1 – measure distance from elbow to ground</p> <p>A1 Measured 6.3 cm, 95.84 cm to 105.84 cm Measured 6.5 cm, 99.2 cm to 109.2 cm</p>
	(c)	<p><u>Kitchen Cabinet</u></p> <p>Compulsory: Sink + corner cabinet + wire basket shelves Cabinet 1 + Cabinet 2 (must go at the junction of the wall) + Cabinet 5 Remaining length = $342 - 50 - 60 - 50 = 172 \text{ cm}$ Remaining width = $135 - 60 = 75 \text{ cm}$ Current total cost = $\\$156 + \\$166 + \\$166 = \\488</p> <p>Along the length – 1 Cabinet 3 + 1 Cabinet 4 (90 cm + 80 cm) Along the width – 1 Cabinet 6 (70 cm) in order to optimise storage</p> <p>Total cost of cabinets = $\\$488 + \\$193 + \\$260 + \\$290 = \\$1231$ Height customisation = $\\$25 \times 6 = \\150 Remaining budget = $\\$2200 - \\$1231 - \\$150 = \\819 \therefore Ceramic or acrylic for materials</p> <p>Mr Graham should choose the Ceramic counter top and his kitchen cabinet combination is one of cabinets 1, 2, 3, 4, 5, 6 with \$19 remaining in his budget.</p>	<p>M1 (Cabinet 1+2+5) M1 (remaining space)</p> <p>M1 (combination of cabinets)</p> <p>M1 – total cost of cabinets M1 – height M1 – budget + conclusion for type of material</p> <p>A1 (relate to budget)</p>
			Total: 10 marks