DUNMAN SECONDARY SCHOOL

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

PRELIMINARY EXAMINATION 2025
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS **4052/02**

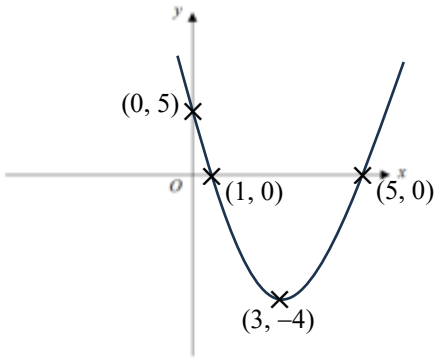
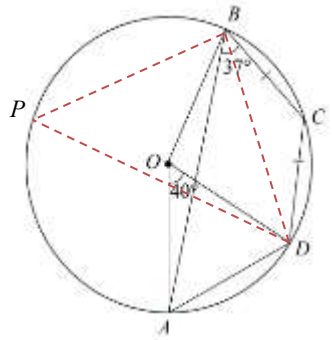
Paper 2 25 August 2026

2 hours 15 minutes

Marking Scheme

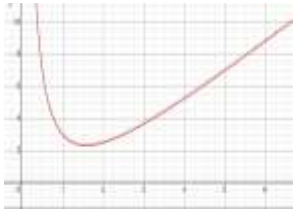
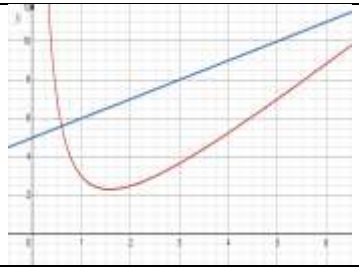
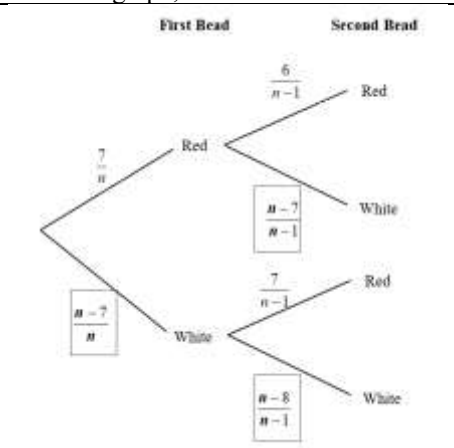
(Updated 1 Dec 2022 by HOD/Math aligned to Marking Scheme for Specimen Papers

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
1a	$5 \le 2x - 7$ **and** $2x - 7 < 11$ $2x \ge 12$ $\quad$ $2x < 18$ $x \ge 6$ $\quad$ $x < 9$	3	M1		
	$6 \le x < 9$		M1		
	The integers are 6, 7 and 8		A1		
1b	$80x^2 - 45y^2$	2			
	$= 5(16x^2 - 9y^2)$		M1		
	$= 5(4x - 3y)(4x + 3y)$		A1		
1c	$\frac{18}{5 - 3x} = 4$ $18 = 20 - 12x$	2	M1	*Rewrite equation to a non-fractional equation.*	
	$\frac{18}{5 - 3x} = 4$ $18 = 20 - 12x$ $12x = 2$ $x = \frac{1}{6}$		A1	*DO NOT accept x = 0.167 or 0.1666* *Can accept* $x = 0.1\dot{6}$ *(recurring decimal)*	
1d (i)	$(x - 3)^2 - 4$ $= x^2 - 6x + 9 - 4$ $= x^2 - 6x + 5$	2	M1	*Show expansion and simplify to the general form of quadratic expression*	
	$= (x - 1)(x - 5)$		A1	*If no working step shown, no marks*	

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
1c(ii)		3	B3	*B1 – positive quadratic curve sketched* *B1 – correct x and y intercepts marked* *B1 – min turning point marked* *No mark awarded if coordinates are not given*	
2a	$\angle ABD = 20^\circ$ (angle at circum = $\frac{1}{2}\times$ angle at centre)	3	M1	*Deduct 1 mark if any reason is not stated*	
	$\angle CBD = 37^\circ - 20^\circ$ $= 17^\circ$		M1		
	$\angle BCD = 180^\circ - 2(17^\circ)$(angle sum of isos triangle BCD) $=146^\circ$		A1		
2b	 Let P be a point on the circle. $\angle BPD = 180^\circ - 146^\circ$(angles in opposite segments) $=34^\circ$	2	M1	*Deduct 1 mark if any reason is not stated*	
	$\angle BOD = 34^\circ \times 2$(angle at centre = 2 $\times$ angle at circum) $=68^\circ$		A1		

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
2c	$\angle AOB = 68^\circ + 40^\circ$ $= 108^\circ$	4	M1		
	Area of sector $OADCB$ $= \frac{108}{360} \times \pi(7^2)$ $= 46.1814 \text{ cm}^2$		M1		
	Area of triangle AOB $= \frac{1}{2}(7^2)\sin 108^\circ$ $= 23.300 \text{ cm}^2$		M1		
	Area of segment $= 46.1819 - 23.300$ $= 22.9 \text{ cm}^2$ (3 sig fig)		A1		
3a	$\begin{pmatrix} 23 & 18 & 39 \\ 17 & 31 & 44 \end{pmatrix}$	1	B1		
3b	k=0.95	1	B1		
3c	**D** $= 0.95\begin{pmatrix} 3700 & 3000 \end{pmatrix}$ $= \begin{pmatrix} 3515 & 2850 \end{pmatrix}$	2	M1	*ecf from 3b*	
	R $= \begin{pmatrix} 3515 & 2850 \end{pmatrix}\begin{pmatrix} 23 & 18 & 39 \\ 17 & 31 & 44 \end{pmatrix}$ $= \begin{pmatrix} 129295 & 151620 & 262485 \end{pmatrix}$		A1		
3d	The elements of **R** represents the **total cost** of the discounted packages sold at the travel fair on **Friday, Saturday and Sunday respectively.**	1	B1		
3e	Total cost of packages sold outside of travel fair = 132($3700) + 95 ($3000) = $773400	4	M1		
	Total cost of packages sold during travel fair = $129295 + $151620 + $262485 = $ 543400		M1	*ecf from 3c*	
	Month's total sales = $773400 + $543400 =$1316800		M1	*ecf*	
	Percentage of month's overall sales $= \frac{543400}{1316800} \times 100\%$ $= 41.3\%$ (3 sig, fig.)		A1		

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
4a	$\overrightarrow{AB} = \frac{2}{3}\overrightarrow{OD}$ $= 2\mathbf{n}$	2	M1		
	$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$ $= 4\mathbf{m} + 2\mathbf{n}$		A1		
4b	$\overrightarrow{AD} = 3\mathbf{n} - 4\mathbf{m}$	4	M1		
	$\overrightarrow{AT} = \frac{2}{5}(3\mathbf{n} - 4\mathbf{m})$		M1		
	$\overrightarrow{OT} = \overrightarrow{OA} + \overrightarrow{AT}$ $= 4\mathbf{m} + \frac{2}{5}(3\mathbf{n} - 4\mathbf{m})$ $= \frac{3}{5}(4\mathbf{m} + 2\mathbf{n})$ $= \frac{3}{5}\overrightarrow{OB}$		M1		
	Since $\overrightarrow{OT} = \frac{3}{5}\overrightarrow{OB}$ and **O is the common point**, therefore **O** , **T** and **B** are collinear.		A1		
5a	$\frac{1}{x} + \frac{1}{x-2} = \frac{1}{4}$ $\frac{2x-2}{x(x-2)} = \frac{1}{4}$	3	M1		
	$4(2x-2) = x(x-2)$ $8x - 8 = x^2 - 2x$		M1		
	$x^2 - 10x + 8 = 0$ (shown)		A1		
5b	$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(8)}}{2(1)}$	3	M2	*M1 for* $\sqrt{(-10)^2 - 4(1)(8)}$	
	$x = 9.12$ or 0.88 (2 dec. places)		A1		
5c	Time Taken =9.123 – 2 = 7.123 hours **= 7 hours 7 minutes**	1	B1		

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
6a	$p = 2.3$	1	B1		
6b		3	B3	P2 : all points plotted correctly Award P1 if 1 to 3 points are plotted wrongly C1 : Curve pass through all points smoothly	
6c(i)	$ax + b = \frac{5}{x} + 2x - 4$ $ax^2 + bx = 5 + 2x^2 - 4x$ $(2-a)x^2 - (4+b)x + 5 = 0$	3	M1		
	$2 - a = 1$ and $4 + b = 9$ $a = 1$ $b = 5$		A2		
6c(ii)		2	B2	*1 mark for correct equation* $y = x + 5$ *1 mark for correct line drawn (ecf)*	
6c(iii)	From the graph, $x = 0.6$	1	B1	*Accept 0.55 or 0.65*	
7a		3	B3		

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
7b	$\frac{7}{n}\left(\frac{6}{n-1}\right)+\frac{n-7}{n}\left(\frac{n-8}{n-1}\right)=\frac{11}{18}$ $\frac{42+(n-7)(n-8)}{n(n-1)}=\frac{11}{18}$	3	M1	*Formulate the equation*	
	$18(42+n^2-15n+56)=11n(n-1)$		M1	*Simplify to a non-fractional equation*	
	$18(42+n^2-15n+56)=11n(n-1)$ $7n^2-259n+1764=0$ $n^2-37n+252=0$ (shown)		A1		
7c	$(n-9)(n-28)=0$	2	M1	*Or using general formula*	
	$n=9$ or 28		A1		
7d	Since there are more white beads than red beads, if n =9, then there is only 2 white beads which is less than the red beads. Therefore, n $\neq$ 9	1	B1		
7e	P(two beads chosen are of different colours) $=1-\frac{11}{18}$ $=\frac{7}{18}$	1	B1		
8a(i)	34 seconds	1	B1		
8a(ii)	ITQ = 60 – 22 = 38	1	B1		
8b	Total number of residents $= 30\times4$ $= 120$	1	B1		
8c(i)	$15 < t \leq 30$	1	B1		
8c(ii)	Estimated mean waiting time $=\frac{7.5(8)+22.5(27)+37.5(10)+52.5(13)+67.5(5)+82.5(2)}{8+27+10+13+5+2}$	1		*Working must be shown to be awarded B1*	
	= 34.269 = 34.3 (3 sig. fig)		B1		
8c(iii)	Standard Deviation $=\sqrt{\frac{100406.25}{65}-34.269^2}$	1		*Working must be shown to be awarded B1*	
	= 19.3 (3 sig. fig.)		B1		
8c(iv)	The lift at Blk 302 is more efficient because **the median waiting time is in the interval of $15 \leq t \leq 30$** is **shorter** than **the median waiting time of Blk 301 which is 34s.**	1	B1		

Qn	Answer	Marks	Partial Marks	Guidance	Markers' Comments
9a	$\angle ADX = \angle CBX$ (alt $\angle$, AD//BC) $\angle AXD = \angle CXB$ (vert. opp $\angle$s) $\triangle CBX$ is similar to $\triangle ADX$ (AA Similarity test)	2	B2	*B1 for each pair of corresponding angles indicated with reason.*	
9b(i)	Area of $\triangle DAX$: Area of $\triangle BCX$ = 4:25	1	B1		
9b(ii)	Note that $\triangle ABD$ and $\triangle ABC$ are triangles of the same height. Area of $\triangle ABD$: Area of $\triangle ABC$ = $AD : BC$ = 2 : 5	1	B1		
9b(iii)	Area of $\triangle ABD$: Area of $\triangle ABC$ = Area of ($\triangle ABX$ + $\triangle DAX$) : Area of ($\triangle ABX$ + $\triangle BCX$) $= 4 + p : 25 + p$ $\frac{4+p}{25+p} = \frac{2}{5}$ $20 + 5p = 50 + 2p$ $3p = 30$ $p = 10$	2	M1		
	area of triangle ABX : area of trapezium $ABCD$ = 10: (10+10+4+25) = 10 : 49		A1		
9c	10 units rep 8 cm^2 Area of shaded region $= \frac{8}{10} \times (4 + 25)$	2	M1		
	=23.2 cm^2		A1		
9d	AB = DC is the additional condition	2	B1	*Alternatively the condition can be* AX= DX or BX = CX	
	Then AX= DX and BX = CX Therefore triangle BAX and triangle CDX will be congruent. (SSS)		B1	*State based on the condition The condition set will make trapezium ABCD an isosceles trapezium*	
10a(i)	Total protein content = 1.2+3.5+18+2.5+1.0 =26.2g	1	B1		
10a(ii)	Amount of energy = 20 + 40 + 80 + 210 + 160	1	B1		

<table>
<tr><th>Qn</th><th>Answer</th><th>Marks</th><th>Partial Marks</th><th>Guidance</th><th>Markers' Comments</th></tr>
<tr><td></td><td>= 510 kCal</td><td></td><td></td><td></td><td></td></tr>
<tr><td>10b</td><td>Base : Brown Rice or Quinoa
Toppings : Sunflower seeds and (Roasted Corn or Avocado Slices)
Main : Tofu Medley
Dressing : Balsamic Vinagrette</td><td>2</td><td>B2</td><td>B1 for Base & Toppings
B1 for Main & Dressing</td><td></td></tr>
<tr><td rowspan="4">10c</td><td>
<table>
<tr><th>Ingredients of Signature Wellness Bowl</th><th>Energy</th><th>Protein</th><th>Sodium</th></tr>
<tr><td>Brown Rice</td><td>250</td><td>6.5</td><td>5</td></tr>
<tr><td>Smoked Duck</td><td>210</td><td>18</td><td>450</td></tr>
<tr><td>Hard-Boiled Egg</td><td>70</td><td>6</td><td>60</td></tr>
<tr><td>Roasted Corn</td><td>65</td><td>2.0</td><td>5</td></tr>
<tr><td>Creamy Caesar</td><td>160</td><td>1.0</td><td>310</td></tr>
<tr><td>Total</td><td>755</td><td>33.5</td><td>830</td></tr>
</table>
</td><td rowspan="4">6</td><td>M3</td><td>B1 for each correct total calculated for energy, protein and sodium</td><td></td></tr>
<tr><td>The Chef's comment is correct as the total energy gained is 755kCAl and the sodium content 830mg have exceeded the standard requirements of between 500 kCal and 700kCal amount of energy and less than 600mg of sodium</td><td>A1</td><td>Must indicate the 2 nutritional standards that are not met.</td><td></td></tr>
<tr><td>
<table>
<tr><th>Ingredients</th><th>Energy</th><th>Protein</th><th>Sodium</th></tr>
<tr><td>Brown Rice</td><td>250</td><td>6.5</td><td>5</td></tr>
<tr><td>Grilled Salmon Fillet</td><td>130</td><td>22</td><td>90</td></tr>
<tr><td>Hard-Boiled Egg</td><td>70</td><td>6</td><td>60</td></tr>
<tr><td>Roasted Corn</td><td>65</td><td>2.0</td><td>5</td></tr>
<tr><td>Creamy Caesar</td><td>160</td><td>1.0</td><td>310</td></tr>
<tr><td>Total</td><td>675kCal</td><td>37.5</td><td>470mg</td></tr>
</table>
</td><td>M1</td><td>.

correct calculation of all 3 nutritional categories.</td><td></td></tr>
<tr><td>Replace the main smoked duck slices with grilled salmon fillet. The amount of energy gained is reduced to 675kCal and the amount of sodium content is also reduced to 470mg and keeping the amount of protein above 25g.</td><td>A1</td><td>State the replacement</td><td></td></tr>
</table>