2024 TKGS PRELIM MATH P1 SOLUTION

Qn		Solution	Content/Success Criteria	
1	**(a)**	8700	I can perform calculations with a calculator. I can round off values to the nearest hundred.	
	(b)	1050	Content	L
			Complexity	L
			Context	L
			Response Strategy	L
			Assessment Objective	AO1

Qn		Solution	Content/Success Criteria	
2	**(a)**	$5-2(6x-1)$ $=5-12x+2$ $=7-12x$	I can expand and simplify algebraic expressions. I can apply simplify expression using laws of indices.	
			Content	L
			Complexity	L
			Context	L
	(b)	$\left(\dfrac{27b^9}{a^6}\right)^{-\frac{1}{3}}=\left(\dfrac{a^6}{27b^9}\right)^{\frac{1}{3}}$	Response Strategy	L
		$=\dfrac{a^2}{3b^3}$	**Assessment Objective**	AO1

<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="5">3</td><td rowspan="5">Let amount of savings Albert and Chris have initially be 5x and 3x respectively.

$\frac{5x-30}{3x-30}=\frac{2}{1}$
$5x-30=2(3x-30)$
$5x-30=6x-60$
$x=30$
$3x=90$
The amount of savings Chris has at the start = $90</td><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>L</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>M</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
</table>

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">4</td><td rowspan="6">(a)

(b)</td><td rowspan="6">$1400=2^3\times5^2\times7$

$1400=2^3\times5^2\times7$
$q=2^2\times3\times7=84$
$\text{HCF}=2^2\times7$

$\therefore q=84$</td><td colspan="2">I can express a number in its prime factors.

I can use the prime factors from HCF to find the original number.</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>H</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>M</td></tr>
<tr><td>Assessment Objective</td><td>AO1/
AO2</td></tr>
</table>

<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">5</td><td rowspan="6">$\frac{1}{2^{a-1}} = 2^3 + 2^3 + 2^3 + 2^3$
$\frac{1}{2^{a-1}} = 32$
$2^{1-a} = 2^5$
Comparing indices,
$1-a=5$
$a=-4$</td><td colspan="2">I can solve equation using laws of indices.
$a^m \times a^n = a^{m+n}$
$a^{-n} = \frac{1}{a^n}$</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>H</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>H</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
<tr><td>OR</td><td>$\frac{1}{2^{a-1}} = 2^3 + 2^3 + 2^3 + 2^3$
$\frac{1}{2^{a-1}} = 2^3(1+1+1+1)$
$\frac{1}{2^{a-1}} = 2^3(2^2)$
$\frac{1}{2^{a-1}} = 2^5$
$2^{-(a-1)} = 2^5$
$-a+1=5$
$a=-4$</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="7">6</td><td>(a)</td><td>$2(5m+3n)^2$
$=2(25m^2+30mn+9n^2)$
$=50m^2+60mn+18n^2$</td><td colspan="2">I can use identity
$(a+b)^2 = a^2+2ab+b^2$
to expand algebraic expressions.</td></tr>
<tr><td rowspan="6">(b)</td><td rowspan="6">$24(mn)^2 - 21mn^3$
$=24m^2n^2 - 21mn^3$
$=3mn^2(8m-7n)$</td><td colspan="2">I can factorise algebraic expressions by taking out common factor.</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>M</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>M</td></tr>
<tr><td>Assessment Objective</td><td>AO1</td></tr>
</table>

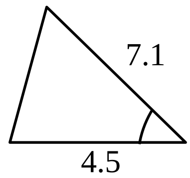
<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">7</td><td rowspan="6">

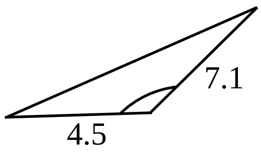
$\frac{1}{2}(4.5)(7.1)\sin\angle XYZ = 12.6$

$15.975\sin\angle XYZ = 12.6$

$\sin\angle XYZ = \frac{12.6}{15.975}$

$\sin\angle XYZ = \frac{56}{71}$





$\angle XYZ = \sin^{-1}\left(\frac{12.6}{15.975}\right)$ or $\angle XYZ = \pi - \sin^{-1}\left(\frac{12.6}{15.975}\right)$

$\angle XYZ = 0.909$ radian $\quad$ $\angle XYZ = 2.23$ radian

</td><td colspan="2">I can use $\frac{1}{2}ab\sin C$ for area of triangle to find sine of acute and obtuse angles in radians.</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>M</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>L</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
</table>

<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">8</td><td rowspan="6">$P=\dfrac{k}{Q^3}$, where k is a non-zero constant
Q is reduced by 20%, substitute original Q with $0.8Q$.
$P_{\text{new}}=\dfrac{k}{(0.8Q)^3}$
$=\dfrac{k}{0.512Q^3}$
New percentage of $P=\dfrac{1}{0.512}\times100\%$
$=195\dfrac{5}{16}\%$
Percentage change in $P=95\dfrac{5}{16}\%$ or 95.3125%</td><td colspan="2">I can use inverse proportion to find percentage change.</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>M</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>L</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
<tr><td>OR</td><td>$Q_{new}=80\%\ of\ Q$
$=\dfrac{4}{5}Q$
$P_{\text{new}}\left(\dfrac{4}{5}Q\right)^3=PQ^3$
$P_{\text{new}}=\dfrac{125}{64}P$
Percentage change in $P=\dfrac{\frac{125}{64}P-P}{P}\times100\%$
$=\dfrac{61}{64}\times100\%$
$=95\dfrac{5}{16}\%$ or 95.3125%</td><td></td><td></td></tr>
</table>

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td>9</td><td>(a)</td><td>$p=\dfrac{\frac{1}{5}+(-6)^2}{\frac{1}{5}-5}$
$=-\dfrac{181}{24}$ or $-7\dfrac{13}{24}$ or -7.54</td><td colspan="2">I can evaluate algebraic expressions by substitution.</td></tr>
<tr><td></td><td>(b)</td><td>$p=\dfrac{q+r^2}{q-5}$
$p(q-5)=q+r^2$
$pq-5p=q+r^2$
$pq-q=r^2+5p$
$q(p-1)=r^2+5p$
$q=\dfrac{r^2+5p}{p-1}$</td><td colspan="2">I can change the subject of the formula.</td></tr>
<tr><td></td><td></td><td></td><td>Content</td><td>L</td></tr>
<tr><td></td><td></td><td></td><td>Complexity</td><td>L</td></tr>
<tr><td></td><td></td><td></td><td>Context</td><td>L</td></tr>
<tr><td></td><td></td><td></td><td>Response Strategy</td><td>L</td></tr>
<tr><td></td><td></td><td></td><td>Assessment Objective</td><td>AO1</td></tr>
</table>

Qn		Solution	Content/Success Criteria	
10	**(a)**	$\sin 30° = \frac{BD}{32}$ $\boxed{DB = 32\sin 30°}$ **Essential step** $= 16$ cm	I can use TOA CAH SOH to find unknown sides in right-angled triangle.	
			Content	L
			Complexity	L
			Context	L
			Response Strategy	L
			Assessment Objective	AO1
	(b)	$AD^2 + BD^2 = 12^2 + 16^2$ $= 400$ $AB^2 = 20^2$ $= 400$ Since $AD^2 + BD^2 = AB^2$, angle $ADB = 90°$ by the converse of Pythagoras' Theorem. Since angle $ADB = 90°$, by the property right angle in semicircle, it is possible to draw diameter AB such that point D lies on the circumference of the circle.	I can use converse of Pythagoras Theorem to prove right angles. I can use right-angle in semicircle to determine that the points in triangle lie on the circumference of circle.	
			Content	H
			Complexity	H
			Context	L
			Response Strategy	H
			Assessment Objective	AO3

Qn	Solution		Content/Success Criteria	
11	$\dfrac{3}{(1-2h)^2}+\dfrac{8}{2h-1}$ $=\dfrac{3}{(1-2h)^2}-\dfrac{8}{1-2h}$ $=\dfrac{3-8(1-2h)}{(1-2h)^2}$ $=\dfrac{3-8+16h}{(1-2h)^2}$ $=\dfrac{-5+16h}{(1-2h)^2}$	Alternatively, $\dfrac{3}{(1-2h)^2}+\dfrac{8}{2h-1}$ $=\dfrac{3}{(2h-1)^2}+\dfrac{8}{2h-1}$ $=\dfrac{3+8(2h-1)}{(1-2h)^2}$ $=\dfrac{3+16h-8}{(1-2h)^2}$ $=\dfrac{16h-5}{(1-2h)^2}$	I can add two algebraic fractions with quadratic denominators.	
			Content	L
			Complexity	M
			Context	L
			Response Strategy	M
			Assessment Objective	AO1

Qn		Solution	Content/Success Criteria	
12	**(a)**	$2k-5$	I can form and solve linear inequalities in one variable.	
	(b)	$2k-5+2k-3>16$ $4k-8>16$ $4k>24$ $k>6$	Content	L
			Complexity	L
			Context	L
			Response Strategy	L
		Smallest possible value of the larger odd number $=2(7)-3$ $=11$	**Assessment Objective**	AO1

Qn	Solution	Content/Success Criteria	
13	$OA = OB = OD$ (radius of circle) Angle $BAO = x°$ (base $\angle s$ of isos Δ) Angle $AOB = 180° - 2x°$ ($\angle$ sum of isosceles Δ) Angle $DAO = y°$ (base $\angle s$ of isos Δ) Angle $AOD = 180° - 2y°$ ($\angle$ sum of isosceles Δ) Angle $BCD = \frac{1}{2}\left[(180° - 2x°) + (180° - 2y°)\right]$ ($\angle$ at centre = 2 $\angle$ at circumference) $= \frac{1}{2}(360° - 2x° - 2y°)$ $= 180° - x° - y°$	I can use angle properties of circles to find an unknown angle.	
		Content	L
		Complexity	L
		Context	L
		Response Strategy	M
		Assessment Objective	AO2
OR	Angle $BAO = x°$ (base $\angle s$ of isos Δ) Angle $DAO = y°$ (base $\angle s$ of isos Δ) Angle $BCD = 180° - x° - y°$ ($\angle s$ in opp. segment)		

Qn		Solution	Content/Success Criteria	
14	**(a)**	$(3x+1)(x-5)$	I can factorise quadratic expression in the form $ax^2 + bx + c$.	
	(b)	$3(y+1)^2 - 14y - 19$ $= 3(y+1)^2 - 14y - 14 - 5$ $= 3(y+1)^2 - 14(y+1) - 5$ By observation with algebraic expression in part (a), it is observed that $y+1 = x$. Using answer from part (a), $\left[3(y+1)+1\right]\left[(y+1)-5\right]$ $= (3y+4)(y-4)$	Content	L
			Complexity	M
			Context	L
			Response Strategy	M
			Assessment Objective	AO1/ AO2

<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">15</td><td rowspan="6">Substitute $x = 2$ and $y = 3$ into equation of the curve
$3 = a(2)^2 + b(2) + 2$
$3 = 4a + 2b + 2$
$1 = 4a + 2b$ ------------------------(1)
Substitute $x = -1$ and $y = -3$ into equation of the curve
$-3 = a(-1)^2 + b(-1) + 2$
$-3 = a - b + 2$
$-5 = a - b$ -------------------------(2)

From (2), $a = -5 + b$ -----------(3)

Substitute (3) into (1)
$1 = 4(-5 + b) + 2b$
$1 = -20 + 4b + 2b$
$21 = 6b$
$b = 3.5$

Substitute $b = 3.5$ into (3)
$a = -5 + 3.5$
$a = -1.5$
Therefore, $a = -1.5$ and $b = 3.5$</td><td colspan="2">I can apply the concept of substituting coordinates of points to form and solve linear equations in two variables.</td></tr>
<tr><td>Content</td><td>M</td></tr>
<tr><td>Complexity</td><td>L</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>L</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
</table>

Qn		Solution	Content/Success Criteria	
16	**(a)**	P(choosing a red marble) $= 1 - \frac{1}{6} - \frac{7}{12}$ $= \frac{1}{4}$ Let the total number of marbles in the bag be *x*. $\frac{1}{4}x = 15$ $x = 15 \times 4$ $= 60$	I can find the probability of single and combined events.	
			Content	L
	(b)	Number of blue marbles $= \frac{1}{6} \times 60$ $= 10$	Complexity	L
			Context	L
		$\frac{10}{60} \times \frac{9}{59}$	Response Strategy	L
		$= \frac{3}{118}$	**Assessment Objective**	AO1

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">17</td><td rowspan="6">(a)</td><td rowspan="6">$\angle BCD = \frac{(5-2)\times 180^\circ}{5}$
$= 108^\circ$ $\angle DCI = \frac{(6-2)\times 180^\circ}{6}$
$= 120^\circ$
$\angle BCI = 360^\circ - 108^\circ - 120^\circ$ ($\angle$s at a point)
$= 132^\circ$

Alternatively,
One ext. $\angle$ of pentagon $= \frac{360^\circ}{5}$
$= 72^\circ$
One ext. $\angle$ of hexagon $= \frac{360^\circ}{6}$
$= 60^\circ$
$\angle BCI = 72^\circ + 60^\circ$
$= 132^\circ$</td><td colspan="2">I can able to apply concepts of interior and exterior angles of polygons and angles at a point to find unknown.

Int. $\angle$ + Ext. $\angle = 180^\circ$
Sum of int. $\angle$s $= (n-2)\times 180^\circ$
Number of sides $= \frac{360^\circ}{\text{Value of 1 ext. } \angle}$</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>L</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>L</td></tr>
<tr><td>Assessment Objective</td><td>AO2</td></tr>
<tr><td rowspan="6"></td><td rowspan="6">(b)</td><td rowspan="6">Exterior angle $= 180^\circ - 132^\circ$
$= 48^\circ$
Number of sides of polygon $= \frac{360^\circ}{48^\circ}$
$= 7.5$
Since the number of sides is not a positive integer greater than 3, BC and CI cannot be sides of a regular polygon.

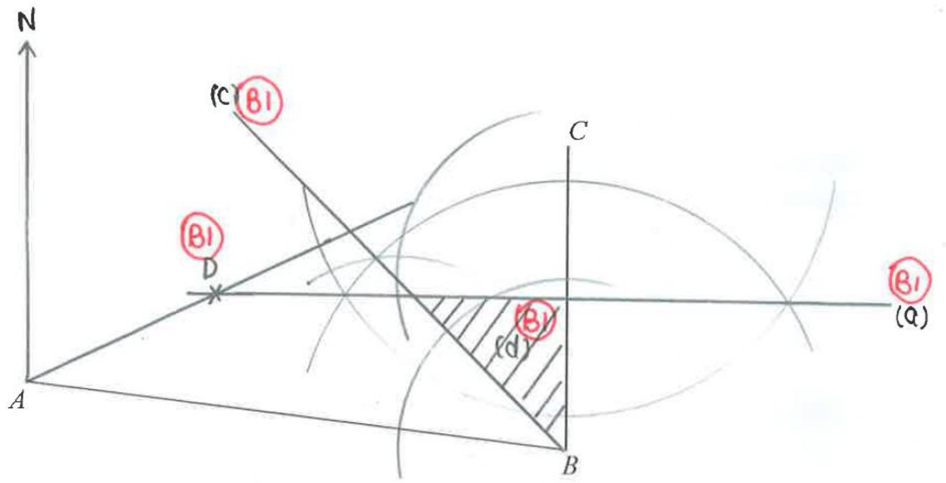
Alternatively, using interior angles of polygon
$132^\circ = \frac{(n-2)\times 180^\circ}{n}$
$132^\circ n = 180^\circ n - 360^\circ$
$48^\circ n = 360^\circ$
$n = 7.5$
Since the number of sides is not a positive integer greater than 3, BC and CI cannot be sides of a regular polygon.</td><td colspan="2">I can use properties of polygons to determine if a polygon has equal sides.</td></tr>
<tr><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>L</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>M</td></tr>
<tr><td>Assessment Objective</td><td>AO3</td></tr>
</table>

Qn		Solution	Content/Success Criteria	
18	**(a)**	$\frac{1}{2}\times\left(\frac{42}{60}+\frac{63}{60}\right)\times v=14$ $\frac{7}{8}v=14$ $v=16$ (shown) Alternatively, $v=\frac{4}{15}$ km/h $=\frac{4}{15}\div 60$ km/h $=16$ km/h or $v=\frac{4}{15}$ km/min $=\frac{4\text{ km}}{\frac{15}{60}\text{ h}}$ $=16$ km/h	I can use distance in speed-time graph to find speed.	
			Content	L
			Complexity	M
			Context	L
			Response Strategy	H
			Assessment Objective	AO2
	(b)	$\frac{5}{11}\times 16$ $=7\frac{3}{11}$ km/h or 7.27 km/h (3 sf)	I can find unknown speed and acceleration in speed-time graph.	
			Content	L
	(c)	Acceleration $=$ Gradient in last 10 mins $=\frac{0-16}{\frac{10}{60}}$ $=-96$ km/h^2	Complexity	L
			Context	L
			Response Strategy	L
			Assessment Objective	AO1

Qn		Solution	Content/Success Criteria	
19	**(a)**	23	I can apply concepts of mode and range to stem-and-leaf diagram.	
	(b)	$\frac{4}{14}\times 100\%=28\frac{4}{7}\%$	Content	L
			Complexity	M
			Context	L
			Response Strategy	M
	(c)	$11+31=42$ $40-31=9$	**Assessment Objective**	AO1/ AO2

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="7">20</td><td>(a)</td><td>$T_5 = \frac{6}{5^4} - \frac{7}{5^5} = \frac{23}{3125}$</td><td colspan="2">I can recognize and represent pattern by finding an algebraic expression for the nth term.
Skills: $5^{n-1} = 5^n \times 5^{-1}$
$5^{-1} = \frac{1}{5}$</td></tr>
<tr><td rowspan="3">(b)</td><td rowspan="3">$T_n = \frac{n+1}{5^{n-1}} - \frac{n+2}{5^n}$
$= \frac{5(n+1)}{5^n} - \frac{n+2}{5^n}$
$= \frac{5(n+1)-(n+2)}{5^n}$
$= \frac{5n+5-n-2}{5^n}$
$= \frac{4n+3}{5^n}$ (shown)</td><td>Content
Complexity</td><td>L
M</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy
Assessment Objective</td><td>M
AO1/ AO2</td></tr>
<tr><td rowspan="3">(c)</td><td rowspan="3">$T_1 + T_2 + T_3 + \ldots + T_{10}$
$= \left(\frac{2}{1} - \frac{3}{5}\right) + \left(\frac{3}{5} - \frac{4}{5^2}\right) + \left(\frac{4}{5^2} - \frac{5}{5^3}\right) + \ldots + \left(\frac{11}{5^9} - \frac{12}{5^{10}}\right)$
$= \frac{2}{1} - \frac{12}{5^{10}}$
$= 2.00$ (to 3 s.f.)</td><td>Content
Complexity</td><td>L
M</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy
Assessment Objective</td><td>H
AO3</td></tr>
</table>

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td rowspan="6">21</td><td>(a)</td><td>$t+12+t-2$
$=(2t+10)$ minutes</td><td colspan="2">I can apply concepts of average speed to find time.</td></tr>
<tr><td rowspan="5">(b)</td><td rowspan="5">$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$ $$10.5=\frac{8.75}{\left(\frac{2t+10}{60}\right)}$$ $$\frac{2t+10}{60}=\frac{8.75}{10.5}$$ $$2t+10=60\left(\frac{8.75}{10.5}\right)$$ $$2t+10=50$$ $$\text{Total time}=50 \text{ minutes}$$ Alternatively: $$10.5 \text{ km/h} = \frac{10.5 \text{ km}}{1 \text{ h}}$$ $$=\frac{10.5 \text{ km}}{60 \text{ min}}$$ $$=\frac{7}{40} \text{ km/min}$$ $$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$ $$\frac{7}{40}=\frac{8.75}{2t+10}$$ $$7(2t+10)=350$$ $$14t+70=350$$ $$14t=280$$ $$t=20$$ $$\text{Time taken for the whole journey}=2(20)+10$$ $$=50 \text{ minutes}$$</td><td>Content</td><td>L</td></tr>
<tr><td>Complexity</td><td>L</td></tr>
<tr><td>Context</td><td>L</td></tr>
<tr><td>Response Strategy</td><td>L</td></tr>
<tr><td>Assessment Objective</td><td>AO1/ AO2</td></tr>
</table>

Qn	Solution	
22	 **Note: North line at A must be parallel to BC because C is due north of B.*	
	Content/Success Criteria	
	I can construct perpendicular bisectors, angle bisectors and points with given bearing. I can draw conclusions of the required area after constructing the bisectors.	
	Content	L
	Complexity	L
	Context	L
	Response Strategy	M
	Assessment Objective	AO1/AO2

Qn		Solution	Content/Success Criteria	
23	(a)(i)	4.2	I can calculate mean and standard deviation from grouped data using a calculator.	
	(a)(ii)	2.47	Content	L
			Complexity	L
			Context	L
			Response Strategy	L
			Assessment Objective	AO1

	(b)	The mean number of books will increase by 2 while the standard deviation value will remain the same.	I can draw simple inferences from mean and standard deviation values.	
			Content	M
			Complexity	L
	(c)	SD of class $A = 2.47$ SD of class $B = 3.15$ Since the standard deviation value of class A is lesser than class B by 0.68, class A has a smaller spread about the mean and the number of books read by class A is more homogeneous in general.	Context	L
			Response Strategy	H
			Assessment Objective	AO3

Qn		**Solution**	**Content/Success Criteria**	
24	**(a)**	$W = 5\begin{pmatrix} 25 & 32 & 40 \\ 21 & 19 & 32 \end{pmatrix}$ $= \begin{pmatrix} 125 & 160 & 200 \\ 105 & 95 & 160 \end{pmatrix}$	I can solve problems involving sum and product of matrices.	
	(b)	$C = \begin{pmatrix} 40 \\ 25 \\ 30 \end{pmatrix}$		
	(c)	$T = \begin{pmatrix} 125 & 160 & 200 \\ 105 & 95 & 160 \end{pmatrix}\begin{pmatrix} 40 \\ 25 \\ 30 \end{pmatrix}$ $= \begin{pmatrix} 15000 \\ 11375 \end{pmatrix}$	Content	L
			Complexity	L
			Context	L
			Response Strategy	M
	(d)	The elements in **T** represent the total amount of school fees paid for weekdays in a week for beginner and advanced students respectively.	**Assessment Objective**	AO1/ AO2

Qn		Solution	Content/Success Criteria	
25	(a)	$OQ = OS$ (radii of small circle) $\angle OQP = \angle OSR$ (radius $\perp$ tangent) $\angle POQ = \angle ROS$ (vert. opp. $\angle$s) ΔOPQ is congruent to ΔORS (ASA congruency test) Alternatively, $OQ = OS$ (radii of small circle) $OP = OR$ (radii of big circle) $\angle PQO = \angle RSO$ (radius $\perp$ tangent) ΔOPQ is congruent to ΔORS (RHS congruency test)	I can determine if two triangles are congruent.	
			Content	L
			Complexity	M
			Context	H
			Response Strategy	H
			Assessment Objective	AO3
	(b)	Let the radius of the small circle be $5r$. $\angle PQO = \angle RSO$ (radius $\perp$ tangent) Area of one shaded triangle $= \frac{1}{2} \times 5r \times 12r$ $= 30r^2$ Area of big circle $= \pi(13r)^2$ $= 169\pi r^2$ Percentage of shaded region $= \frac{2 \times 30r^2}{169\pi r^2} \times 100\%$ $= \frac{60}{169\pi} \times 100\%$ $= 11.3\%$ (3 s.f.)	I can use ratio and percentage to find area of circles and triangles.	
			Content	L
			Complexity	L
			Context	H
			Response Strategy	M
			Assessment Objective	AO2
OR		Let the radius of the small circle be r. $PQ = \frac{12}{5}r$ $OP = \frac{13}{5}r$ Area of one shaded triangle $= \frac{1}{2} \times r \times \left(\frac{12}{5}r\right)$ $= 1.2r^2$ Area of big circle $= \pi\left(\frac{13}{5}r\right)^2$ $= 6.76\pi r^2$ Percentage of shaded region $= \frac{2 \times 1.2r^2}{6.76\pi r^2} \times 100\%$ $= \frac{2.4}{6.76\pi} \times 100\%$ $= 11.3\%$ (3 s.f.)		