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)	$\left(\frac{27b^9}{a^6}\right)^{-\frac{1}{3}} = \left(\frac{a^6}{27b^9}\right)^{\frac{1}{3}}$ $= \frac{a^2}{3b^3}$	Response Strategy	L
			Assessment Objective	AO1

Downloaded from SingaKids.com

Qn	Solution	Content/Success Criteria	
3	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	Content	L
		Complexity	L
		Context	L
		Response Strategy	M
		Assessment Objective	AO2

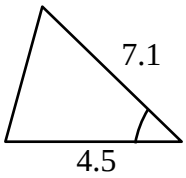
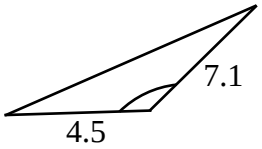
Qn		Solution	Content/Success Criteria	
4	**(a)**	$1400=2^3\times5^2\times7$	I can express a number in its prime factors.	
	(b)	$1400=2^3\quad\times5^2\times7$ $q=2^2\times3\quad\times7=84$ $\text{HCF}=2^2\quad\times7$ $\therefore q=84$	I can use the prime factors from HCF to find the original number.	
			Content	L
			Complexity	H
			Context	L
			Response Strategy	M
			Assessment Objective	AO1/ AO2

Downloaded from SingaKids.com

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

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

Downloaded from SingaKids.com

Qn	Solution	Content/Success Criteria
7	$\frac{1}{2}(4.5)(7.1)\sin\angle XYZ = 12.6$ $15.975\sin\angle XYZ = 12.6$ $\sin\angle XYZ = \frac{12.6}{15.975}$ $\sin\angle XYZ = \frac{56}{71}$   $\angle XYZ = \sin^{-1}\left(\frac{12.6}{15.975}\right)$ or $\angle XYZ = \pi - \sin^{-1}\left(\frac{12.6}{15.975}\right)$ $\angle XYZ = 0.909$ radian $\angle XYZ = 2.23$ radian	I can use $\frac{1}{2}ab\sin C$ for area of triangle to find sine of acute and obtuse angles in radians.

Content	L
Complexity	M
Context	L
Response Strategy	L
Assessment Objective	AO2

Downloaded from SingaKids.com

Qn	Solution	Content/Success Criteria	
8	$P = \frac{k}{Q^3}$, where k is a non-zero constant Q is reduced by 20%, substitute original Q with $0.8Q$. $P_{\text{new}} = \frac{k}{(0.8Q)^3}$ $= \frac{k}{0.512Q^3}$ New percentage of $P = \frac{1}{0.512} \times 100\%$ $= 195\frac{5}{16}\%$ Percentage change in $P = 95\frac{5}{16}\%$ or 95.3125%	I can use inverse proportion to find percentage change.	
		Content	L
		Complexity	M
		Context	L
		Response Strategy	L
		Assessment Objective	AO2
OR	$Q_{new} = 80\% \text{ of } Q$ $= \frac{4}{5}Q$ $P_{\text{new}}\left(\frac{4}{5}Q\right)^3 = PQ^3$ $P_{\text{new}} = \frac{125}{64}P$ Percentage change in $P = \frac{\frac{125}{64}P - P}{P} \times 100\%$ $= \frac{61}{64} \times 100\%$ $= 95\frac{5}{16}\%$ or 95.3125%		

Downloaded from SingaKids.com

Qn		Solution	Content/Success Criteria
9	(a)	$p = \dfrac{\frac{1}{5} + (-6)^2}{\frac{1}{5} - 5}$ $= -\dfrac{181}{24}$ or $-7\dfrac{13}{24}$ or -7.54	I can evaluate algebraic expressions by substitution.
	(b)	$p = \dfrac{q + r^2}{q - 5}$ $p(q-5) = q + r^2$ $pq - 5p = q + r^2$ $pq - q = r^2 + 5p$ $q(p-1) = r^2 + 5p$ $q = \dfrac{r^2 + 5p}{p-1}$	I can change the subject of the formula.

Content	L
Complexity	L
Context	L
Response Strategy	L
Assessment Objective	AO1

Downloaded from SingaKids.com

Qn		Solution	Content/Success Criteria	
10	**(a)**	$\sin 30° = \frac{BD}{32}$ $DB = 32\sin 30°$ **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

Downloaded from SingaKids.com

Qn	Solution		Content/Success Criteria	
11	$\frac{3}{(1-2h)^2}+\frac{8}{2h-1}$ $=\frac{3}{(1-2h)^2}-\frac{8}{1-2h}$ $=\frac{3-8(1-2h)}{(1-2h)^2}$ $=\frac{3-8+16h}{(1-2h)^2}$ $=\frac{-5+16h}{(1-2h)^2}$	Alternatively, $\frac{3}{(1-2h)^2}+\frac{8}{2h-1}$ $=\frac{3}{(2h-1)^2}+\frac{8}{2h-1}$ $=\frac{3+8(2h-1)}{(1-2h)^2}$ $=\frac{3+16h-8}{(1-2h)^2}$ $=\frac{16h-5}{(1-2h)^2}$	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)	$2k-5+2k-3>16$ $4k-8>16$ $4k>24$ $k>6$ Smallest possible value of the larger odd number $=2(7)-3$ $=11$	Content	L
			Complexity	L
			Context	L
			Response Strategy	L
			Assessment Objective	AO1

Downloaded from SingaKids.com

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

Downloaded from SingaKids.com

<table>
<tr><th>Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td>15</td><td>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></td><td></td><td>Content</td><td>M</td></tr>
<tr><td></td><td></td><td>Complexity</td><td>L</td></tr>
<tr><td></td><td></td><td>Context</td><td>L</td></tr>
<tr><td></td><td></td><td>Response Strategy</td><td>L</td></tr>
<tr><td></td><td></td><td>Assessment Objective</td><td>AO2</td></tr>
</table>

Downloaded from SingaKids.com

<table>
<tr><th colspan="2">Qn</th><th>Solution</th><th colspan="2">Content/Success Criteria</th></tr>
<tr><td>16</td><td>(a)</td><td>$\text{P(choosing a red marble)} = 1 - \frac{1}{6} - \frac{7}{12}$
$= \frac{1}{4}$
Let the total number of marbles in the bag be x.
$\frac{1}{4}x = 15$
$x = 15 \times 4$
$= 60$</td><td colspan="2">I can find the probability of single and combined events.</td></tr>
<tr><td></td><td>(b)</td><td>$\text{Number of blue marbles} = \frac{1}{6} \times 60$
$= 10$
$\frac{10}{60} \times \frac{9}{59}$
$= \frac{3}{118}$</td><td>Content
Complexity
Context
Response Strategy
Assessment Objective</td><td>L
L
L
L
AO1</td></tr>
</table>

Downloaded from SingaKids.com

Qn		Solution	Content/Success Criteria
17	(a)	$\angle BCD = \dfrac{(5-2)\times 180°}{5}$ $= 108°$ $\angle DCI = \dfrac{(6-2)\times 180°}{6}$ $= 120°$ $\angle BCI = 360° - 108° - 120°$ ($\angle$s at a point) $= 132°$	I can able to apply concepts of interior and exterior angles of polygons and angles at a point to find unknown. Int. $\angle$ + Ext.$\angle = 180°$ Sum of int. $\angle$s $= (n-2)\times 180°$ Number of sides $= \dfrac{360°}{\text{Value of 1 ext. } \angle}$
		Alternatively, One ext. $\angle$ of pentagon $= \dfrac{360°}{5}$ $= 72°$ One ext. $\angle$ of hexagon $= \dfrac{360°}{6}$ $= 60°$ $\angle BCI = 72° + 60°$ $= 132°$	Content: L Complexity: L Context: L Response Strategy: L **Assessment Objective**: AO2
	(b)	Exterior angle $= 180° - 132°$ $= 48°$ Number of sides of polygon $= \dfrac{360°}{48°}$ $= 7.5$ Since the number of sides is not a positive integer greater than 3, *BC* and *CI* cannot be sides of a regular polygon.	I can use properties of polygons to determine if a polygon has equal sides.
		Alternatively, using interior angles of polygon $132° = \dfrac{(n-2)\times 180°}{n}$ $132°n = 180°n - 360°$ $48°n = 360°$ $n = 7.5$ Since the number of sides is not a positive integer greater than 3, *BC* and *CI* cannot be sides of a regular polygon.	Content: L Complexity: L Context: L Response Strategy: M **Assessment Objective**: AO3

Downloaded from SingaKids.com

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

Downloaded from SingaKids.com

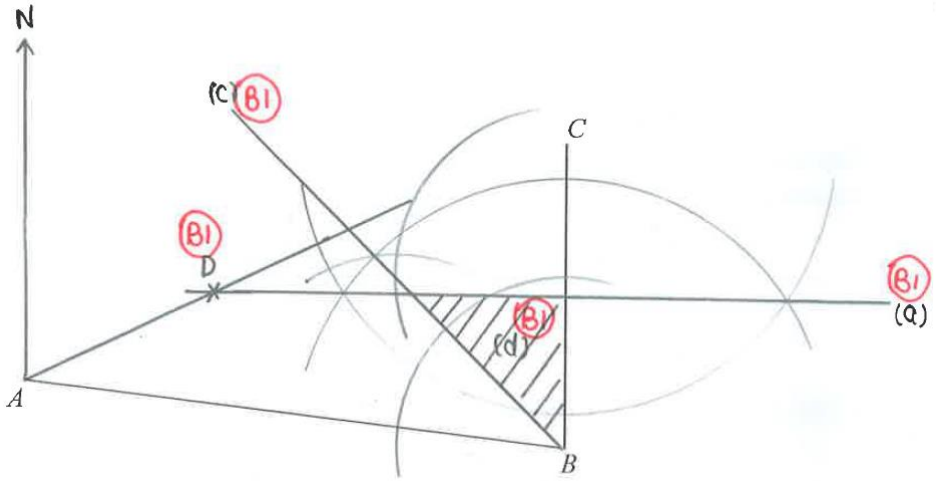
Qn		Solution	Content/Success Criteria	
20	**(a)**	$T_5 = \frac{6}{5^4} - \frac{7}{5^5} = \frac{23}{3125}$	I can recognize and represent pattern by finding an algebraic expression for the *n*th term. Skills: $5^{n-1} = 5^n \times 5^{-1}$ $5^{-1} = \frac{1}{5}$	
	(b)	$T_n = \frac{n+1}{5^{n-1}} - \frac{n+2}{5^n}$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

Downloaded from SingaKids.com

Qn		Solution	Content/Success Criteria
21	**(a)**	$t+12+t-2$ $=(2t+10)$ minutes	I can apply concepts of average speed to find time.
	(b)	$\text{Average speed} = \dfrac{\text{Total distance}}{\text{Total time}}$ $10.5 = \dfrac{8.75}{\left(\dfrac{2t+10}{60}\right)}$ $\dfrac{2t+10}{60} = \dfrac{8.75}{10.5}$ $2t+10 = 60\left(\dfrac{8.75}{10.5}\right)$ $2t+10 = 50$ $\text{Total time} = 50$ minutes ***Alternatively:*** $10.5 \text{ km/h} = \dfrac{10.5 \text{ km}}{1 \text{ h}}$ $= \dfrac{10.5 \text{ km}}{60 \text{ min}}$ $= \dfrac{7}{40}$ km/min $\text{Average speed} = \dfrac{\text{Total distance}}{\text{Total time}}$ $\dfrac{7}{40} = \dfrac{8.75}{2t+10}$ $7(2t+10) = 350$ $14t+70 = 350$ $14t = 280$ $t = 20$ $\text{Time taken for the whole journey} = 2(20)+10$ $= 50$ minutes	

Content	L
Complexity	L
Context	L
Response Strategy	L
Assessment Objective	AO1/ AO2

Downloaded from SingaKids.com

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

Downloaded from SingaKids.com

	(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

Downloaded from SingaKids.com

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.)		

Downloaded from SingaKids.com