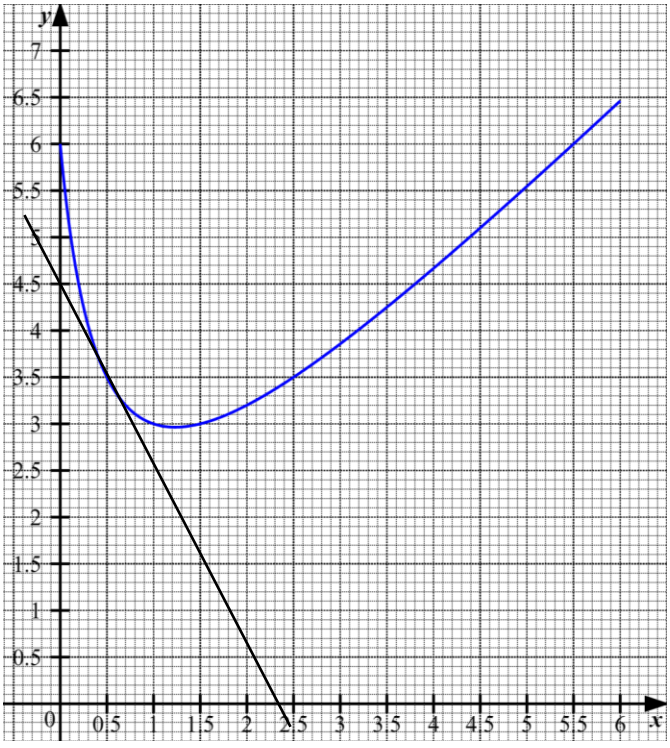
Anglo-Chinese School
(Barker Road)

Marking Scheme and Markers' Report
Secondary 3 Express
Mathematics 4052
End-of-Year Examination Paper 2 2023

Qn	Part	
1	(a)	$\frac{42980}{104.2} =$ S$412.476
		$412.476 - 620 = \$207.52$
	(b)	$11313 = 10000\left(1+\frac{r}{100}\right)^3$
		$\sqrt[3]{\frac{11313}{10000}} - 1 = \frac{r}{100}$
		$r = 4.20$
	(c)	Deposit = $15\%(2480) = \$372$
		$\frac{2772-372}{12} = \$200$
2	(a)	$\sqrt{(3-0)^2+(0-3)^2} = 4.24264 = 4.24$ units
	(b)	$\frac{5-0}{k-3} = \frac{5}{4}$
		$20 = 5k - 15$
		$5k = 35$
		$k = 7$ (shown)
	(c)	$c = -3\frac{3}{4}$
		$y = \frac{5}{4}x - 3\frac{3}{4}$
	(d)	(0, 7)
3	(ai)	$\frac{V_1}{V_2} = \left(\sqrt{\frac{9}{16}}\right)^3 = \frac{27}{64}$
	(aii)	Capacity of can A = $\frac{768\pi}{64} \times 27 = 324\pi$ cm^3
		$\pi r^2 (9) = 324\pi$
		$r = 6$ cm
	(bi)	$AP = BQ$ (mid points of sides of a square)
		$\angle BAP = \angle CBQ$ (right angle of a square)
		$AB = BC$ (sides of a square)
		$\therefore \Delta APB \equiv \Delta BQC$ (SAS Test)

	(bii)	Since $\therefore \Delta APB \equiv \Delta BQC$, $\angle APB + \angle ABP = \angle BQC + \angle ABP = 90°$ $\therefore \angle BXC = 90°$ (exterior angle of triangle *BQX*)
4	**(ai)**	$\frac{1}{2}(50)(t-8) = \frac{1}{2}(t+t-8)(20)$ $25t - 200 = 20t - 80$ $5t = 120$ $t = 24$
	(aii)	$\frac{1}{2}(24+24-8)(20) \div 24 = 16.7$ m/s
	(b)	$\frac{50}{24-8} = \frac{25}{8} = 3.125$ m/s^2
	(c)	$\frac{20}{r-8} = \frac{25}{8}$ $160 = 25r - 200$ $r = 14.4$
5	**(ai)**	$\angle BCA = 90° - 31° = 59°$ (angle in a semicircle)
	(aii)	$\angle CDE = 180° - 59° = 121°$ (angles in opp. segments)
	(aiii)	reflex $\angle COE = 2 \times 121° = 242°$ $(\angle$ at centre=2 $\angle$ at circumference$)$ $\angle COE = 360° - 242° = 118°$ $(\angle$ at a point$)$
	(aiv)	$\angle OAE = \frac{118°}{2} = 59°$ (angles in same segment) Since $\angle OAE = \angle BCA$, *BC* is parallel to *AE* since they are alternate angles.
	(bi)	$\cos 0.8 = \frac{15}{OA}$ $OA = 21.5298 = 21.5$ cm
	(bii)	$\frac{1}{2}(21.5298^2)(0.8) - \frac{1}{2}(15)(21.5298)(\sin 0.8)$ $= 185.412 - 115.833 = 69.578 = 69.6$ cm^2
6	**(ai)**	$\cos \angle QPS = \frac{5.5^2 + 4.8^2 - 3.7^2}{2(5.5)(4.8)}$ $\angle QPS = 41.4096 = 41.4°$
	(aii)	Bearing of Q from P = 20° Bearing of S from P = 20° + 41.4096° = 061.4°

	(aiii)	$\angle RQS = 40.5°$ $\frac{SR}{\sin 40.5} = \frac{3.7}{\sin 65}$ $SR = 2.65137 = 2.65 \text{ km}$
	(b)	$\sin 40.5 = \frac{d}{3.7}$ $d = 2.402957 = 2.40 \text{ km}$ $\tan\theta = \frac{0.58}{2.402957}$ max angle of elevation $= 13.569 = 13.6°$
7	**(a)**	6.0 m^3
	(b)	
	(c)	Min volume at 1.2 h
	(di)	Tangent drawn Gradient = -2
	(dii)	The rate of decrease of the volume of rainwater in the open tank after 0.5 hour.

8	**(a)**	$\frac{70\times 2}{100}=1.4$ m
	(b)	Conversion of either 5 m/s to km/h or vice versa to compare the speeds. Yes/No, according to the speed limit indicated on either the footpath or cycling/shared path. (*follow conversion working*).
	(c)	$\text{Min time} = \frac{\text{total distance covered}}{\text{max speed}}$ $=\frac{2.2+0.0017}{25}=0.088068=5 \text{ min } 20 \text{ sec}$
	(d)	Let max speed of design *B* be *x* m/s. Hence, max speed of design *A* be $(x+1.5)$ m/s. $\frac{270}{x}-15=\frac{270}{x+1.5}$ $270(x+1.5)-15x(x+1.5)=270x$ $270x+405-15x^2-22.5x=270x$ $2x^2+3x-54=0$ $(2x-9)(x+6)=0$ $x=4.5$ or -6 (rejected) Maximum speed of Design *A*: 6 m/s Maximum speed of Design *B*: 4.5 m/s
	(e)	$4.5 \text{ m/s}=\frac{(4.5\times 3600)}{1000}=16.2 \text{ km/h}$ $6 \text{ m/s}=\frac{(6\times 3600)}{1000}=21.6 \text{ km/h}$ Since both PMD designs adhere to the maximum speed limit imposed by LTA as shown in the infographic, it is recommended for Mr Ang to purchase design *A* for his ten-year old son as it is lighter and smaller.