Carlingford High School

Year 11 Mathematics

Term 2 Assessment Task 2020

Time allowed: 50 minutes

Student Number: Solutions ..... Class: 11MAA.....

Teacher: (Please Circle)	Mr Cheng	Ms Strilakos	Ms Tang
Mr Fardouly/ Mrs Wilson	Ms Bennett	Mr Gong	Mr Wilson

Instructions

- Answer each question in the space provided
- Marks may be deducted for careless or badly arranged work
- All answers are to be completed in blue or black pen except graphs and diagrams
- No lending or borrowing
- Board approved calculators may be used

Functions	Trigonometry	Total	
/16	/25	/41	%

F 1-4 Ken

F 5-6 + T 1-3 Peter

T 4-8 Grace

T 9-11 Alex

Functions (16 marks)

1. Which equation represents the line perpendicular to $2x - 3y = 1$, passing through the point $(0, 2)$?

(A)	$3x + 2y = 4$	B	$3x + 2y = 6$	1
C	$3x - 2y = -4$	D	$3x - 2y = 6$	

$m_1 = \frac{2}{3}$

$m_2 = -3/2$

2. Find the equation of the straight line with angle of inclination $30°$ passing through the point $(\sqrt{3}, 2)$. 2

$m = \tan 30°$

$= 1/\sqrt{3}$ ✓

$y - 2 = 1/\sqrt{3}(x - \sqrt{3})$

$y = \frac{1}{\sqrt{3}}x + 1$ or $x - \sqrt{3}y + \sqrt{3} = 0$ ✓

3. The lines $x + 2y + 5 = 0$ and $3x - y + 1 = 0$ intersect at a point P.

a) Find the coordinates of P 2

$y = 3x + 1$

$x + 2(3x + 1) + 5 = 0$

$7x + 7 = 0$

$x = -1$ ✓

$y = -3 + 1$

$y = -2$

$P = (-1, -2)$ ✓

b) Find the equation of the line passing through P which is parallel to the line $4x - y + 1 = 0$. Give your answer in general form. 2

~~$y = 4x + 1$~~

$\therefore m = 4$ ✓

$y + 2 = 4(x + 1)$

$4x - y + 4 - 2 = 0$

$4x - y + 2 = 0$ ✓

4. The SRC is selling cards as a fundraiser. They spend \$30 on equipment, and estimate that it costs \$2 in supplies to make each pack of cards. They plan to sell the cards for \$3.50 per pack.

a) Set up the cost, C, and revenue, R, functions for the sale of x items. **2**

$C = 30 + 2x$ ✓

$R = 3.5x$ ✓

b) Determine the point at which cost is equal to revenue. **1**

$30 + 2x = 3.5x$

$30 = 1.5x$

$x = 20$ ✓

c) How many packs of cards would need to be sold to raise \$450? **1**

$450 = 3.5x - (30 + 2x)$

$450 = 1.5x - 30$

$480 = 1.5x$

$x = 320$

320 packs. ✓

5. Solve the simultaneous equations : $y = x^2 - 1$ **2**

$y = x + 1$

$x^2 - 1 = x + 1$

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

$x = 2, -1$ ✓

if $x = 2$ $y = 3$

if $x = -1$, $y = 0$.

The solutions are $(2,3)$ and $(-1,0)$ ✓

6. For what values of m do the line $y = mx - 4$ and the parabola $y = x^2 - 2x - 2$ intersect twice? **3**

Intersections : $x^2 - 2x - 2 = mx - 4$

$x^2 - (2+m)x + 2 = 0$

$\Delta > 0$ for 2 points of intersection

$\Delta = (2+m)^2 - 4 \times 2$ ✓

$\Delta = m^2 + 4m - 4$

When $\Delta = 0$, $m = \dfrac{-4 \pm \sqrt{16+16}}{2}$

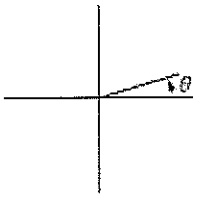
$= -2 \pm 2\sqrt{2}$

$m < -2 - 2\sqrt{2}$ or $m > -2 + 2\sqrt{2}$ ✓ ✓

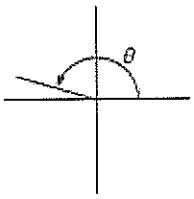
Trigonometry (25 marks)

1. For the angle θ, $\sin\theta = -\frac{7}{25}$ and $\cos\theta = \frac{24}{25}$. Which diagram best shows the angle θ?

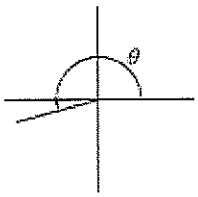
A



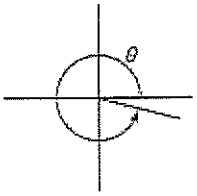
B



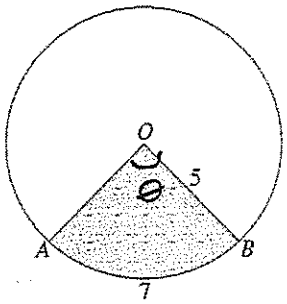
C



D



2. The circle centred at O has radius 5 and arc length AB is 7 as shown in the diagram.



$\theta = \frac{7}{5}$

$A = \frac{\theta}{2\pi} \times \pi r^2$

$= \frac{7}{2} \times 5$

What is the area of the shaded sector OAB?

A $\frac{35\pi}{2}$

B $\frac{35}{2}$

C $\frac{125\pi}{14}$

D $\frac{125}{14}$

3. Find the exact value of

a) $\sin 300° = -\sin 60° = -\frac{\sqrt{3}}{2}$ 1

b) $\cos 765° = \cos 405° = \cos 45° = \frac{1}{\sqrt{2}}$ 1

c) $\operatorname{cosec} \frac{4\pi}{3}$ $\frac{1}{\sin(\pi + \frac{\pi}{3})} = \frac{1}{-\frac{\sqrt{3}}{2}} = -\frac{2}{\sqrt{3}}$ 1

G. Tang

4. Find all values of θ, $0° \leq \theta \leq 2\pi$ for which $\cos\theta + \sqrt{3}\sin\theta = 0$ 2

$\sqrt{3}\sin\theta = -\cos\theta$

$\sqrt{3}\tan\theta = -1$

$\tan\theta = -\frac{1}{\sqrt{3}}$

$\theta = \pi - \frac{\pi}{6}, 2\pi - \frac{\pi}{6}$

150°, 330°

$\theta = \frac{5\pi}{6}, \frac{11\pi}{6}$ √√

1 mark for 1 correct solution OR 1st quadrant value in radians

5. If $\sin A = x$, express $\cos(90° - A)\sin(180° - A)$ in terms of x. 2

$\cos(90° - A) = \sin A$

$= x$

$\sin(180° - A) = \sin A$

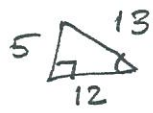
$= x$

[1 mark for either identity]

$\therefore \cos(90° - A)\sin(180° - A) = x^2$

6. If $\operatorname{cosec} a = -\frac{13}{5}$ and $\cot a > 0$, find the exact value of $\cos a$. 2

$\sin a = -\frac{5}{13}$



$\sqrt{13^2 - 5^2} = 12$ ✓

3rd quadrant ∴ cos -ve

$\cos a = -\frac{12}{13}$ ✓

7. Prove the identity $(1 + \tan x)^2 + (1 - \tan x)^2 = 2\sec^2 x$ 2

$LHS = 1 + 2\tan x + \tan^2 x + 1 - 2\tan x + \tan^2 x$

$= 2 + 2\tan^2 x$ ✓

$= 2(1 + \tan^2 x) = 2\sec^2\theta = RHS$

$\sec^2 x = 1 + \tan^2 x$

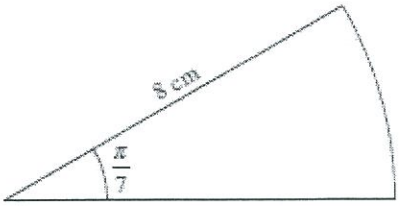
$= 2\left(\frac{\cos^2 x + \sin^2 x}{\cos^2 x}\right)$

$= 2\left(\frac{1}{\cos^2 x}\right)$

$= 2\sec^2 x$

$= RHS$ ✓

8. The angle of a sector in a circle of radius 8 cm is $\frac{\pi}{7}$ radians, as shown in the diagram.



NOT TO SCALE

Find the exact value of the perimeter of the sector. **2**

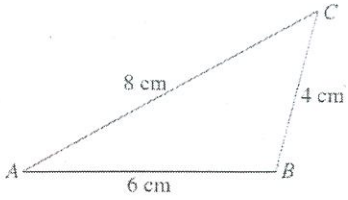
$l = r\theta$

$= \frac{8\pi}{7}$ ✓ 3.59

$P = \boxed{\frac{8\pi}{7} + 16 \text{ cm}}$ or $\boxed{\frac{112 + 8\pi}{7} \text{ cm}}$ ✓

19.59

9. The diagram shows ΔABC with $AB = 6$ cm, $AC = 8$ cm and $CB = 4$ cm.



NOT TO SCALE

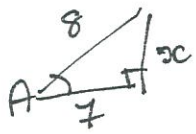
a) Show that $\cos A = \frac{7}{8}$ **1**

$4^2 = 8^2 + 6^2 - 2 \times 8 \times 6 \cos A$

$\cos A = \frac{8^2 + 6^2 - 4^2}{2 \times 8 \times 6}$

$= \frac{84}{96} = \frac{12 \times 7}{12 \times 8} = \frac{7}{8}$

b) By finding the exact value of $\sin A$, find the exact area of ΔABC. **2**



$x^2 = 8^2 - 7^2$

$= 15$

$\sin A = \frac{\sqrt{15}}{8}$ ✓

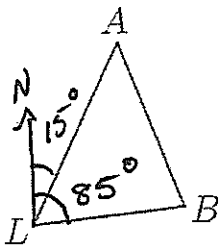
Area $= \frac{1}{2} 8 \times 6 \sin A$

$= \frac{1}{2} \times 8 \times 6 \frac{\sqrt{15}}{8}$

$= 3\sqrt{15} \text{ cm}^2$ ✓

10. Boat A is 30 km from lighthouse L on a bearing of 015° and boat B is 20 km from L on a bearing of 085°

a) How far apart are the boats? Give your answer correct to 1 decimal place. 2



$AB^2 = 30^2 + 20^2 - 2\times30\times20\cos70$ ✓

$AB = \sqrt{889.5758...}$

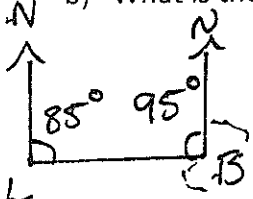
$\approx 29.8257...$

≈ 29.8 km ✓

$\angle ALB = 85 - 15$

$= 70°$

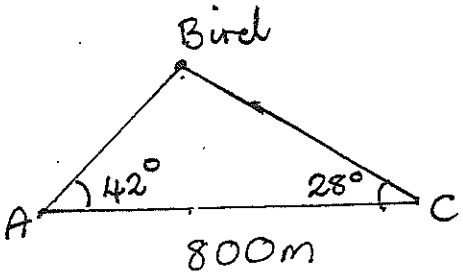
b) What is the bearing of the lighthouse as seen from boat B? 1



$360 - 95 = 265°$

11. From the ends of a straight horizontal section of road 800 m long, a bird hovering directly above the road is observed to have angles of elevation of 42°and 28° respectively.

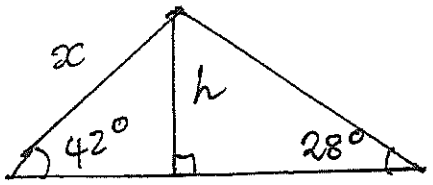
a) Using a ruler, draw a diagram representing this information. 1



b) Find the height of the bird above the road, correct to the nearest metre. 3

$\angle ABC = 180 - 42 - 28$

$= 110°$ ✓



$\frac{x}{\sin 28°} = \frac{800}{\sin 110°}$

$x = \frac{800\sin 28°}{\sin 110°}$ ✓

(or equivalent using $\sin 42°$)

$h = x\sin 42°$

$= \frac{800\sin 28°\sin 42°}{\sin 110°}$

$= 267.4387...$

≈ 267 m ✓

Can also evaluate

$x \approx 399.68$ m

$h = 399.68\sin 42°...$

End of Exam. Please check your work.