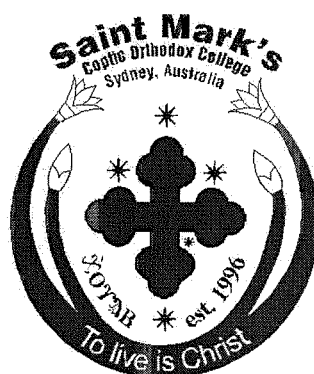


Name: _____

Teacher: _____

ST MARK'S COPTIC ORTHODOX COLLEGE

Mathematics Department



2009

Year 11 Extension 1

Semester One Examination

GENERAL INSTRUCTION

- Reading time 5 minutes
- Working Time – 2 hours
- Write in black or blue pen only
- Approved calculators may be used

- All necessary working must be shown
- Begin each question on a different booklet
- Attempt all questions
- All question are of equal value

Section	1	2	3	4	5	6	7	Total
Mark								/84

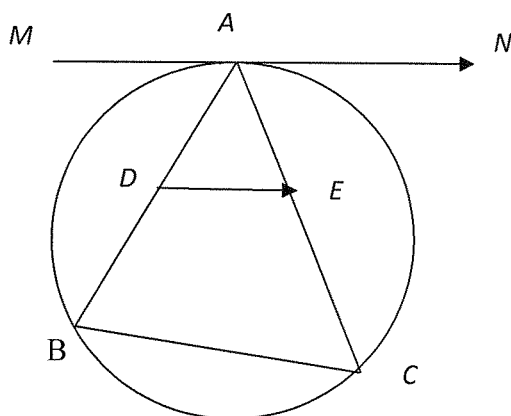
Question 1 (12 marks) *Start work on a new page*

Mark

- | | | |
|----|---|---|
| a) | Factorise, then simplify $\frac{9-x}{81-x^2}$ | 2 |
| b) | Simplify $\frac{\sqrt{5}-1}{\sqrt{5}+1} + \frac{\sqrt{5}+1}{\sqrt{5}-1}$ | 3 |
| c) | Solve for x : $ 2x-1 < 3$ | 2 |
| d) | Solve for x : $\frac{5}{2x-1} < 1$ | 3 |
| e) | Write $\frac{1+\sqrt{7}}{3-\sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are rational. | 2 |

Question 2 (12 marks) *Start work on a new page*

- a) $A(-2, 5)$ and $B(1, 2)$ are two fixed points. Find the coordinates of the point P which divides AB externally in the ratio 3:2. 2
- b) ABC is a triangle inscribed in a circle. MAN is the tangent to the circle at A . Points D, E lie on AB, AC respectively, so that DE is parallel to MAN .

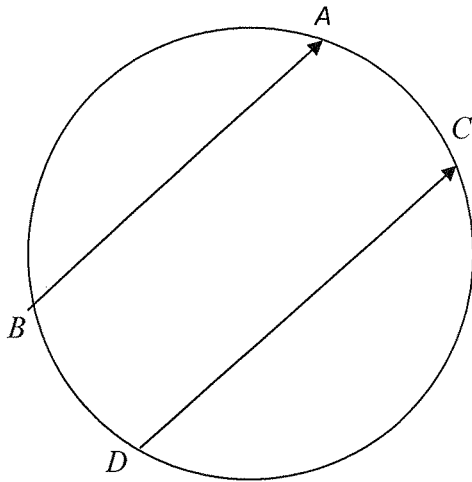


- | | | |
|-----|--|---|
| i) | Explain why angles MAB and ACB are equal | 1 |
| ii) | Hence show that $BCED$ is a cyclic quadrilateral | 3 |
| c) | Sketch the graph $y = x-3 $ | 2 |
| d) | Solve the equation $2x-9 = \frac{-9}{x}$ | 2 |
| e) | On the same set of axes, sketch the graph of $y = 2x-9$ and $y = \frac{-9}{x}$ | 2 |

Question 3 (12 marks) *Start work on a new page*

Marks

a)



A , B , C and D are four points on a circle such that AB is parallel to CD . Prove that $AD = BC$

4

Hint: Let E be the point of intersection of AD and BC .

- b) Find the acute angle between the lines $3x - y = 4$ and $2x + 3y = 4$. Write your answer to the nearest minute.

2

- c) Find $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x - 3}$

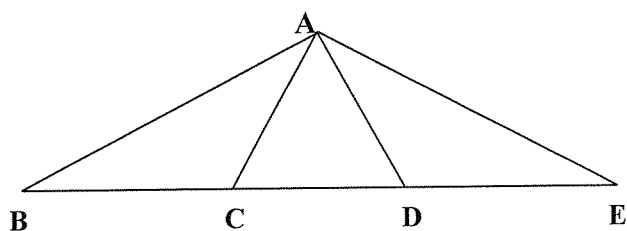
2

- d) Prove $\frac{\tan x - \tan y}{\tan x + \tan y} = \frac{\sin(x - y)}{\sin(x + y)}$

4

Question 4 (12 marks) *Start work on a new page*

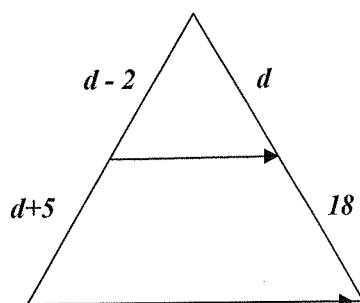
a)



$AC = AD = BC = DE$. Prove $AB = AE$

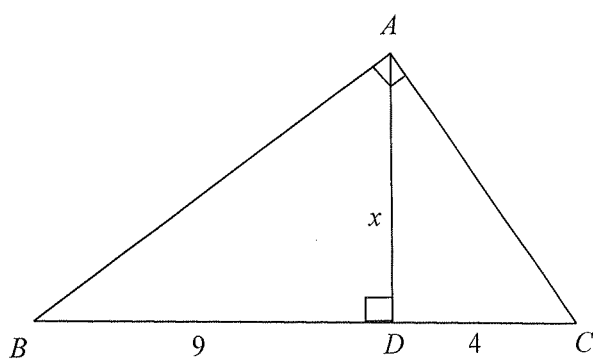
4

b) Find the value of the pronumeral giving reasons



4

c) Find the value of the pronumeral, giving reasons. *Hint show $\triangle ABD$ is Similar to $\triangle ADC$.*



4

Question 5 (12 marks) *Start work on a new page*

- a) A student lies down on the ground and views the top of a church tower at an angle of elevation of 40° . If the student is 50m from the foot of the tower, which is on the same level with the student, how high is the tower to 2 decimal places? Draw a neat diagram 3
- b) From a sailboat the window of a light house is seen at an angle of elevation of 40° . After moving towards the lighthouse a distance of 50m, the angle of elevation is found to be 43° . How far off is the sailboat from the lighthouse to the nearest metre? 4
- c) From a ship that is running due north the lighthouse is seen at the bearing of $N30^\circ E$, and after 2km of sailing the lighthouse is seen at $N48^\circ E$.
- (i) Draw a neat diagram, illustrating the above information 2
- (ii) Calculate the distance from the ship to the lighthouse to 2 decimal places. 3

Question 6 (12 marks) *Start work on a new page*

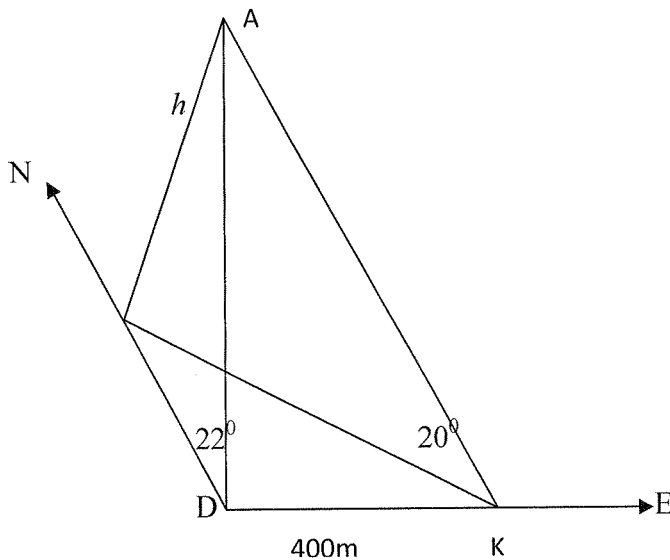
Marks

- | | | |
|----|--|----------|
| a) | Sketch $f(x) = \frac{1}{x^2-1}$ Show all essential features. | 3 |
| b) | If θ is an acute angle and $\tan\theta = \alpha$, express $\cos\theta$, $\sin\theta$ in terms of α | 2 |
| c) | Solve $4\sin^2x = 1, 0^\circ \leq x \leq 360^\circ$ | 2 |
| d) | Solve $3\cos^2x = 8\sin x, 0 \leq x \leq 360$, giving your answer to the nearest minute | 3 |
| e) | If $\sin\alpha = \frac{1}{2}$, find the exact value of $\cos 2\alpha$ | 2 |

Question 7 (12 marks) *Start work on a new page*

- a) (i) Write the expansion for $\cos(\alpha + \theta)$ 1
(ii) Hence or otherwise prove that $\cos 3\theta = 4\cos^3\theta - 3\cos\theta$ 3
(iii) Solve $8\cos^3\theta - 6\cos\theta - \sqrt{3} = 0$ for $0^\circ \leq \theta \leq 360^\circ$ 3

- b) Donna is standing at D and observes the angle of elevation of the tip of a flagpole A , on top of a building to be 22° . Her friend Kate, who is standing at K , 400 metres due east of Donna, finds the angle of elevation of the tip of the flagpole to be 20° . The building is due north of Donna and B is the base of the building. The points B , D and K are all on level ground.



- (i) Show that the height h , of the flagpole above the ground is given by 3

$$h = \frac{400}{\sqrt{(\cot^2 20^\circ - \cot^2 22^\circ)}}$$

- (ii) Find the value of h , correct to 3 significant figures. 2