Caringbah High School

Year 11 2016

Mathematics Extension 1

Preliminary Course

Assessment Task 4

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
- Write using black or blue pen
- Board-approved calculators may be used
- The approved board of studies reference sheet has been provided
- In Questions 6-10, show relevant mathematical reasoning and/or calculations. Marks may not be awarded if sufficient reasons and working have not been shown.
- Marks may not be awarded for partial or incomplete answers

Total marks – 65

Section I **5 marks**

Attempt Questions 1-5

Mark your answers on the Multipe Choice answer sheet provided. You may detach the sheet and write your name on it.

Section II **60 marks**

Attempt Questions 6-10

Write your answers in the answer booklets provided. Ensure your name or student number is clearly visible. **Answer Q10 (d) on the answer sheet provided.** Detach it from the back of this exam paper and write your name and class and **place it in the Q10 answer booklet when the exam is collected.**

Name: _____ **Class:** _____

Marker's Use Only							
Section I	**Section II**					**Total**	
Q 1-5	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**		
/5	/12	/12	/12	/12	/12	/65	%

Section I

5 marks
Attempt Questions 1-5
Allow about 8 minutes for this section

Use the multiple-choice answer sheet for Questions 1–5

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1. If $\cos x \cos y = \frac{1}{4}\left(\sqrt{3} - \sqrt{2}\right)$ and $\sin x \sin y = \frac{1}{4}\left(\sqrt{3} + \sqrt{2}\right)$ then the least positive value of $x - y$ will be :

(A) 30°

(B) 45°

(C) 135°

(D) 150°

2. The values of m of the equation $x^2 - 3mx + (m+3) = 0$ if one root is double the other are :

(A) $\frac{3}{2}, -1$

(B) $-\frac{3}{2}$, 1

(C) $-\frac{3}{2}, -1$

(D) $\frac{3}{2}$, 1

3. The values for A, B and C in the quadratic identity $3x^2 - 5x + 2 \equiv A(x+1)^2 - B(x+1) + C$ are

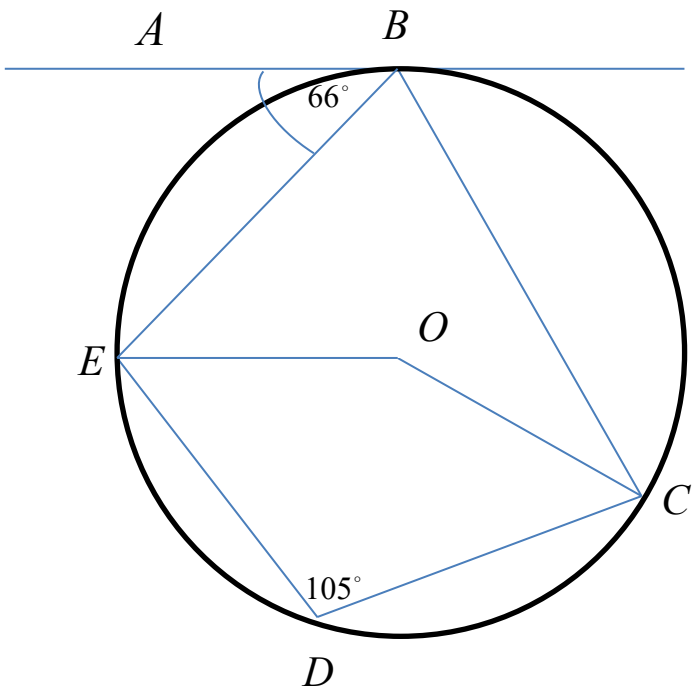
(A) $A = 3, B = -5, C = 2$

(B) $A = 3, B = 5, C = 10$

(C) $A = 3, B = -11, C = 10$

(D) $A = 3, B = 11, C = 10$

4. In the following diagram O is the centre of the circle and AB is a tangent to the circle at B.
$\angle BCO =$



(A) 11°

(B) 51°

(C) 24°

(D) 33°

5. $\dfrac{4^n - 1}{4^n - 2^n} =$

(A) $2^n - 1$

(B) $2^{-n} - 1$

(C) $2^n + 1$

(D) $2^{-n} + 1$

End of Section I

Section II

60 marks
Attempt Questions 6–10
Allow about 1 hour 22 minutes for this section

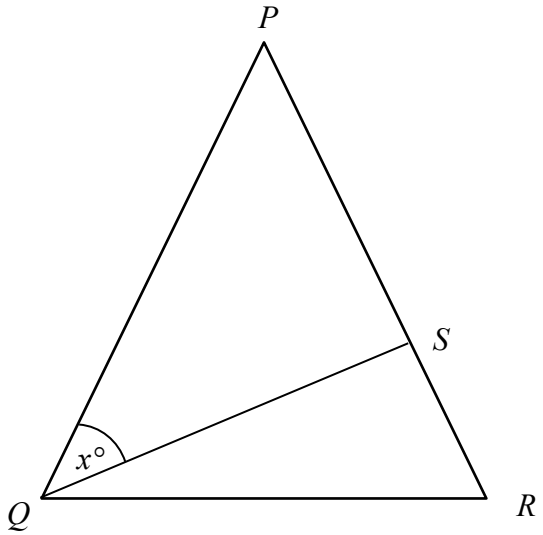
Answer each question in a SEPARATE writing booklet.

Your responses should include relevant mathematical reasoning and/or calculations.

Question 6 (12 marks) Use a SEPARATE writing booklet.

(a) If $y = \dfrac{x^2 - 3}{x^2 + 2x}$ find $\dfrac{dy}{dx}$ **3**

(b) In the diagram not drawn to scale ΔPQR is isosceles with $PQ = PR$. **3**
Also $PS = QS = QR$
Find the value of x° giving reasons. Make sure you copy the diagram onto your answer sheet and clearly mark all given data on it.



(c) Differentiate $f(x) = x^2 - 2x$ from first principles **3**

(d) Find the equation of the normal to the curve $y = x + \dfrac{1}{x}$ at the point (1, 2) **3**

End of Question 6

Question 7 (12 marks) Use a SEPARATE writing booklet.

(a) $f(x) = \dfrac{4}{3 + x^2}$

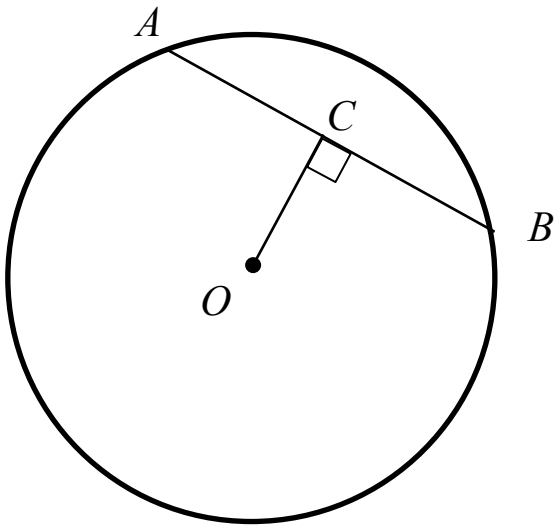
(i) Is $f(x)$ even, odd or neither? Show why. **1**

(ii) Find $\lim\limits_{x \to \infty} f(x)$ **1**

(iii) Hence draw a sketch of *f(x)* showing any intercepts or asymptotes. **2**

(b) Solve for x: $2^{2x+1} - 17 \times 2^x + 8 = 0$ **2**

(c) In the diagram below, prove that *OC* bisects *AB*, where *O* is the centre of the circle and $OC \perp AB$. **2**
(You must draw a 1/3 page diagram for this proof)



(d) Show that $\sin(2x + 30) = \sqrt{3} \sin x \cos x + \cos^2 x - \dfrac{1}{2}$ **2**

(e) Draw a sketch of the graph of the function $y = \dfrac{2}{|x|}$. Use at least 1/3 of a page and show all relevant points and asymptotes. **2**

End of Question 7

Question 8 (12 marks) Use a SEPARATE writing booklet.

(a) Solve $\frac{x}{2x-1} \leq 5$ **3**

(b) **(i)** Express $\sqrt{3}\sin x + \cos x$ in the form $r\sin(x+\alpha)$ **1**

(ii) Hence or otherwise solve $\sqrt{3}\sin x + \cos x = 1$ for $0^\circ \leq x^\circ \leq 360^\circ$ **2**

(c) For what values of k does $3x^2 - kx + 3 = 0$ have real and distinct roots. **2**

(d) For the points $A(-3,-7)$ and $B(-1,-4)$ find the co-ordinates of the point $P(x, y)$ that divides AB externally in the ratio 4:3. **2**

(e) The point $Q(0,3)$ divides the line segment $C(-2,7)$ and $D(x, y)$ internally in the ratio 2:3. Find the coordinates of D. **2**

End of Question 8

Question 9 (12 marks) Use a SEPARATE writing booklet.

(a) Differentiate the following functions and express in simplest factorised form.

(i) $f(x) = \left(x^2 + 1\right)^3 (2x + 1)$ **3**

(ii) $f(x) = \dfrac{x+1}{\sqrt{2x-2}}$ **3**

(b) Either using the fact that the line through the point of intersection of two lines l_1 and l_2 may be written in the form $l_1 + kl_2$, or otherwise, find the equation of the line through the point of intersection of the lines $x - y - 1 = 0$ and $3x - 2y - 1 = 0$ that has a gradient of $\dfrac{-1}{2}$. **3**

(c) Solve the equation for x : $\sqrt{x} + \sqrt{3x+1} = 3$ **3**

End of Question 9

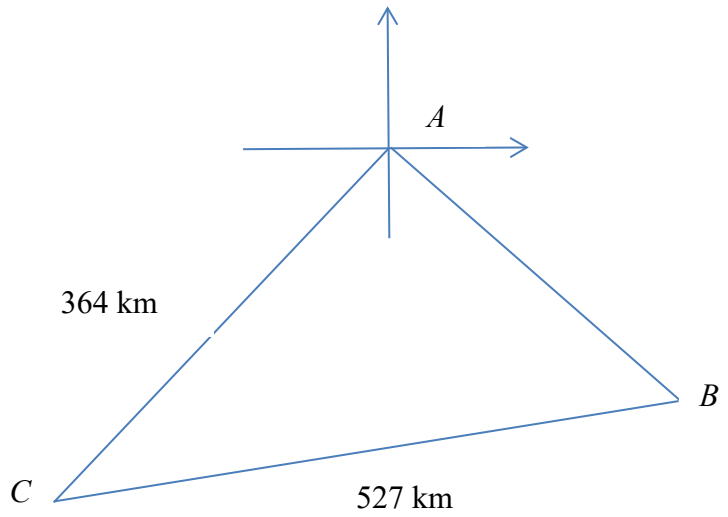
Question 10 (12 marks) Use a SEPARATE writing booklet.

(a) For the quadratic equation $2x^2 - 3x - 4 = 0$ with roots α and β, find the value of

(i) $\alpha^2 + \beta^2$ **2**

(ii) $\dfrac{1}{\alpha} + \dfrac{1}{\beta}$ **1**

(b) The diagram below shows the path of a plane flying from town A on a bearing of 237° to town C, which is 364km away. At town C the plane changes course and travels 527km on a bearing of 077° to town B.



(i) Copy the above diagram onto your answer sheet and find the size of $\angle ACB$. Make sure to show your working. **1**

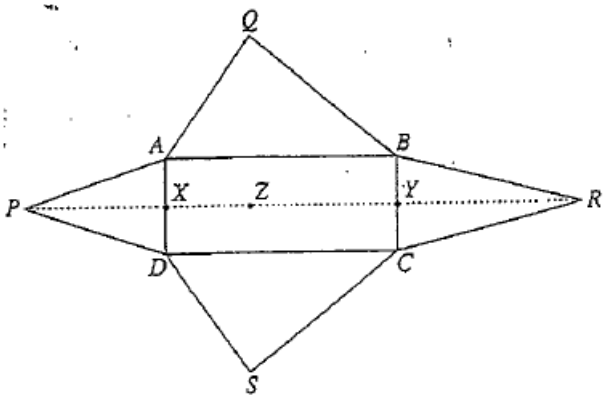
(ii) Find the distance of town A from town B to the nearest km. **1**

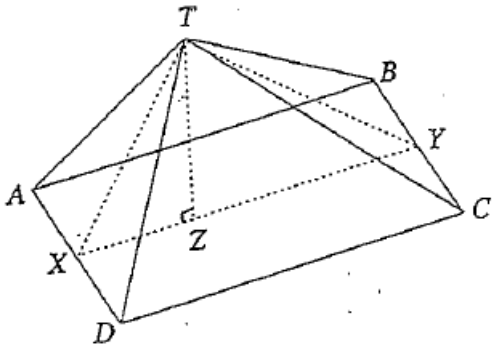
(c) The straight lines $3x - 5y - 1 = 0$ and $bx - 2y + 2 = 0$ are inclined to each other at an angle of 45°. Find the possible values of b. **3**

Question 10 continues on page 9

(d) The figure shows the net of an oblique pyramid (not drawn to scale) with a rectangular base. In this figure, $PXZYR$ is a straight line, $PX = 15$cm, $RY = 20$cm, $AB = 25$cm and $BC = 10$cm. Further, $AP = PD$ and $BR = RC$ and X and Y are the midpoints of AD and BC respectively.
When the net is folded, points *P, Q, R and S* all meet at the apex T, which lies vertically above the point Z in the horizontal base as shown in the diagram below.

(The diagrams have been reproduced on an answer sheet. Make sure you write your answer to this question on the answer sheet provided at the back of the exam paper. Detach it and place it in the Q10 answer booklet.)





(i) Show that triangle TXY is right-angled. **1**

(ii) Hence show that T is 12cm above the base. **2**

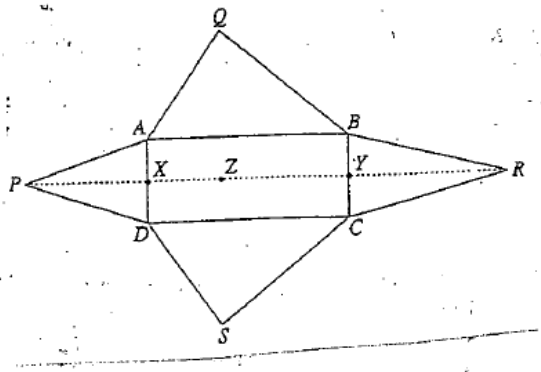
(iii) Hence find the angle that the face DCT makes with the base to the nearest minute. **1**

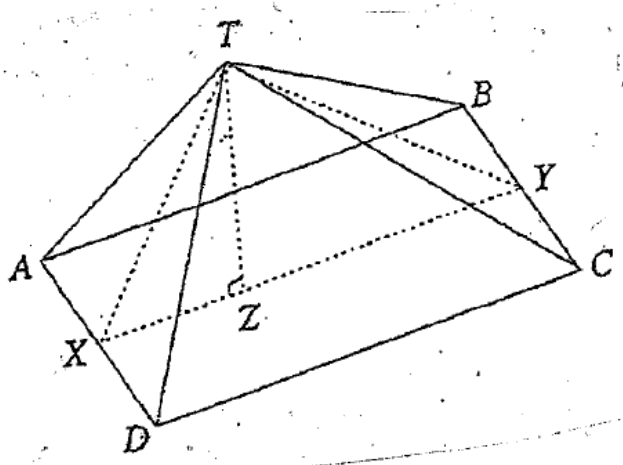
End of Paper

Question 10 (d) Answer Sheet

Name :_____

Class :_____





(i) Show that triangle TXY is right-angled. **1**

(ii) Hence show that T is 12cm above the base. **2**

(iii) Hence find the angle that the face DCT makes with the base to the nearest minute. **1**