



**GOLD COAST  
CHRISTIAN  
COLLEGE**

Christ Centred  
Service Oriented  
Innovative Learning

## MATHEMATICAL METHODS

### REV SHEET - T3-W3

**Student name** Ben Trim

**Student number**

**Teacher** Mr Mc°Clintock

**Date** Friday, Term 3 Week 3

**Technique** Homework Sheet

**Unit** Unit 4

**Topic** Topic 1, Topic 2, Topic 3, Topic 4, Topic 5

**Time** 1 week

**Seen / unseen** Take home questions

**Other**

Please ensure that you show **all** working out.

	Questions	Score	Marks
Topic 1	1 - 4		19
Topic 2	5 - 8		25
Topic 3	9 - 11		11
Topic 4	12 - 13		6
Topic 5	14 - 15		6
Total			67

## Topic 1

### Question 1 (TF)

[4 marks]

The position,  $x$  metres, from a fixed origin at time  $t$  seconds of two particles travelling in a straight line are given by  $x_1(t) = 6t^3 - 54t^2 + 6t - 10$  and  $x_2(t) = (t - 3)^4$  respectively for  $0 \leq t \leq 10$ .

(a) Determine each particle's acceleration at  $t = 2$

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(b) Determine the times (if any) when the acceleration of both particles is equal.

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[5 marks]

**Question 3**

[4 marks]

For each of the following, determine the absolute maximum and minimum values over the specified domain.

(a)  $f(x) = -2(x + 1)(x - 2) + 5, \quad x \in [-3, 2].$

[2]

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(b)  $f(x) = 3(x + 1)(x - 2)(x - 4) + 5, \quad x \in [-5, 2].$

[2]

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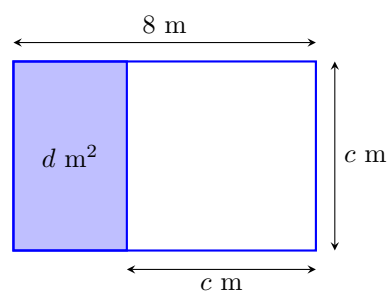
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### Question 4

[6 marks]

The following diagram shows a rectangle with side lengths 8 m and  $c$  m. The area of the shaded region is  $d$  m<sup>2</sup>. Determine the maximum possible value of  $d$  and the corresponding value of  $c$ .



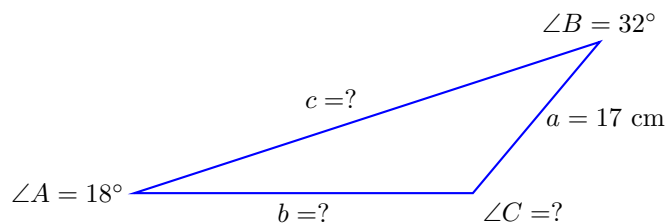
## Topic 2

### Question 5

[9 marks]

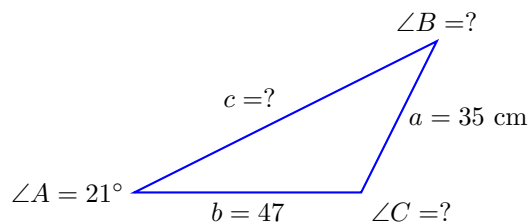
Use the sine rule to determine the unknown value(s) in each of the following.

(a)



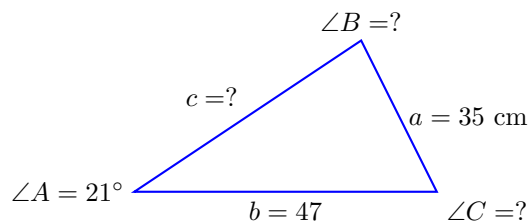
[3]

(b)



[3]

(c)



[3]

Question 6

[6 marks]

For triangle  $ABC$  with:

- (a)  $a = 24$ ,  $b = 42$ ,  $C = 32^\circ$ , determine  $c$ .

[1]

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- (b)  $b = 35$ ,  $c = 49$ ,  $A = 39^\circ$ , determine  $a$ .

[1]

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- (c)  $c = 22$ ,  $a = 44$ ,  $B = 59^\circ$ , determine  $b$ .

[1]

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- (d)  $a = 24$ ,  $b = 42$ ,  $c = 65$ , determine  $A$ ,  $B$  and  $C$ .

[3]

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Question 7

[4 marks]

A triangle has vertices  $A$ ,  $B$  and  $C$ . Side  $AB$  is 21 cm and side  $BC$  is 14 cm.  $\angle ABC = 41^\circ$ .

- (a) Determine the length of the third side  $AC$ , correct to the nearest centimetre.

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- (b) Determine the size of the other two angles, correct to the nearest degree.

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- (c) Determine the area of the triangle, correct to 1 decimal place.

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[6 marks]

## Topic 3

### Question 9 (TA)

[2 marks]

Determine the exact values of the mean and variance for each of the following Bernoulli distributions, correct to 2 decimal places.

**Please note:** We incorrectly wrote down the formula for variance in 15B. I have fixed this in OneNote. It should have been  $\text{var}(X) = p(1 - p)$ , which is exactly the same for a binomial distribution, but with  $n = 1$ .

- (a) Scoring a one on a roll of a die.

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- (b) Three coins are flipped, and you record whether there are at most two heads.

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Question 10 (TF)

[4 marks]

For each of the following, calculate the exact value of any unknown  $n$  or  $p$ .

**Please note:** Our textbook did not use this terminology.  $X \sim B(n, p)$  is a shorthand way of writing that  $X$  is a binomial random variable, with the specified  $n$  and  $p$  values (in that order).

(a)  $X \sim B(21, p)$ ,  $E(X) = 7$

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(b)  $X \sim B(n, 1)$ ,  $E(X) = 1$

[1]

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(c) A binomial random variable,  $X$  has a mean of 36 and a variance of 9 (calculate  $n$  and  $p$ ).

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[5 marks]

Calculate the values of  $n$  and  $p$ , hence determine the number of turns that would be required to have a 99% chance of winning at least 3 prizes.

## Topic 4

### Question 12 (TF)

[2 marks]

Our textbook did not use this terminology.  $X \sim N(\mu, \sigma)$  is a shorthand way of writing that  $X$  is a normal random variable, with the specified  $\mu$  and  $\sigma$  values (in that order).

- (a) If  $X \sim N(20, 4)$  determine the exact  $z$ -value corresponding to  $x = 19$ .

[1]

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- (b) A normal random variable  $X$  has a mean of 60. The value 45 has a standardised value of  $-3$ , determine the standard deviation.

[1]

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### Question 13 (TA)

[4 marks]

The useful life of a school laptop is known to be normally distributed with a mean life of 4 years and a variance of 0.4.

- (a) What is the probability that a laptop will have a useful life of less than 3 years? Give your answer correct to 4 decimal places.

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- (b) Determine the probability that a laptop will have a useful life between 4 and 4.5 years. Give your answer correct to 4 decimal places.

[1]

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- (c) Historically 55% of laptops have a useful life that is less than the manufacturer's advertised life. Determine the manufacturer's advertised life as a whole number of months.

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## Topic 5

### Question 14 (TA)

[3 marks]

A 95% confidence interval is used to obtain an estimate for a population with a sample proportion of 0.9.

- (a) Determine the margin of error if the sample size is 650.

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- (b) Determine the sample size that will generate a margin of error of 2%.

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Question 15 (TA)

[3 marks]

In a survey, it was found that 43% of 90 people preferred Mexican food to Asian food.

- (a) Calculate the expected value, correct to 2 decimal places.

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- (b) Calculate the margin of error, correct to 3 decimal places.

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- (c) Assess the normality.

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