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do other terms may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor before reading any

Important note to candidates

Special items:
drawing instruments, templates, notebooks or up to two unfolded sheets of A4 paper, and up to three calculators, CAs, graphic or scientific, which satisfy the conditions set by the Curriculum Council for this course.

Standard items: pens, pencils, pencil sharpener, highlighter, eraser, ruler.

Formula sheet.

Question/answer booklet for Section Two.

to be provided by the supervisor

Material required/recommended for this section

Working time for paper: 100 minutes

Reading time before commencing work: 10 minutes

Time allowed for this section

Teacher

Name

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Calculator Assumed) Student Number

Section Two

MATHEMATICS 3C/3D

Question/Answer Booklet

Semester I Examination 2011



Structure of this examination

	Number of questions	Working time (minutes)	Marks available
Section One Calculator Free	8	50	40
This Section (Section 2) Calculator Assumed	15	100	80
Total marks			120

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Instructions to candidates

1. The rules for the conduct of WACE external examinations are detailed in the booklet *WACE Examinations Handbook*. Sitting this examination implies that you agree to abide by these rules.
2. Answer the questions in the spaces provided.
3. Spare answer pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued i.e. give the page number.
4. Show all working clearly. Any question, or part question, worth more than 2 marks requires valid working or justification to receive full marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.

See Next Page

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[2]

- (b) Two of the girls who applied are the twins Brooke and Alisa. Assuming that all possible committees have the same probability of being formed, what is the probability that both Brooke and Alisa are selected?

[3]

- (a) How many different committees can be formed?

Perth Modern School decides to form a committee of 6 people to edit the school magazine. 9 girls and 6 boys apply, and the school decides to appoint 4 girls and 2 boys.

Question 9 (5 marks)

Suggested working time for this section is 100 minutes.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Space pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

This section has **Fifteen (15)** questions. Answer all questions. Write your answers in the space provided.

Section Two: Calculator-assumed CALCULATOR ASSUMED (80 Marks)

Question 10**(5 marks)**

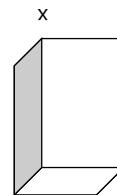
Calculate the area between the two functions $f(x) = -x^2 + 2x + 7$ and $g(x) = 2x^2 - 4x - 2$ using calculus techniques.

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Additional working space

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[2]

(a) Find an expression for h in terms of x .

[2]

(b) Show that the volume, V , of the tank equals $\left(\frac{27x}{4} - \frac{4}{x^3} \right) m^3$.

[3]

(c) Hence calculate the maximum volume possible for this tank using calculus techniques.

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[5]

(b) A vase is in the shape of an inverted cone with an angle at the apex of 60° . Water is being poured into the vase at a rate of 10 ml per second . Find the rate of change of the radius of the water surface when the radius is 8 cm .

[1]

CALCULATOR ASSUMED
MATHEMATICS 3C3D(b) State the population size when $t = 5$.

(c) Determine the doubling time for the population.

[2]

Question 23

(a) A block of ice in the shape of a hemisphere is melting so that its total surface area diminishes at a rate of $20 \text{ cm}^2/\text{h}$. What is the rate of change of its radius when the radius is 4 cm ?

[4]

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Question 12

(3 marks)

In an array of dots, there are 7 in the top row and 10 in the bottom row:



Triangles are formed by selecting 3 dots as vertices, 2 in the top row and 1 in the bottom row, or vice versa.

How many different triangles are possible?

Question 13

(4 marks)

An electrical store has 10 lamps left in its storeroom. Four of the lamps have defective wiring and should not be used. A new store assistant randomly selects three of the lamps for a customer, and checks them without replacement.

Let X be the number of defective lamps purchased by the customer.

Find the probability distribution for X .

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- (c) The shaded region is revolved 360° around the x axis.

(i) Write down the expression for the volume of the solid generated. [2]

- (ii) Determine the volume generated exactly. [1]

Question 22

[4 marks]

A population, y , increases according to the differential equation:

$$\frac{dy}{dt} = 0.04y \quad \text{where } t \text{ is the time, in years, after the start of 2000}$$

The population at the start of 2000 has size 1 000.

- (a) State the equation for population, y , in terms of t . [1]

Nathan and Tarduin are members of the squad. How many different teams are possible (do not simply) if there are 35 players in a football squad but only 28 are to be selected to form a team.

- [T] (a) all players are available?

- [T] (b) Nathan must be included?

- [T] (c) Tarduin is injured and cannot play?

- [T] (d) Nathan will not be included but Tarduin must play?

- [T] (e) Nathan and Tarduin must be included in the team?

[2]

[2]

[2]

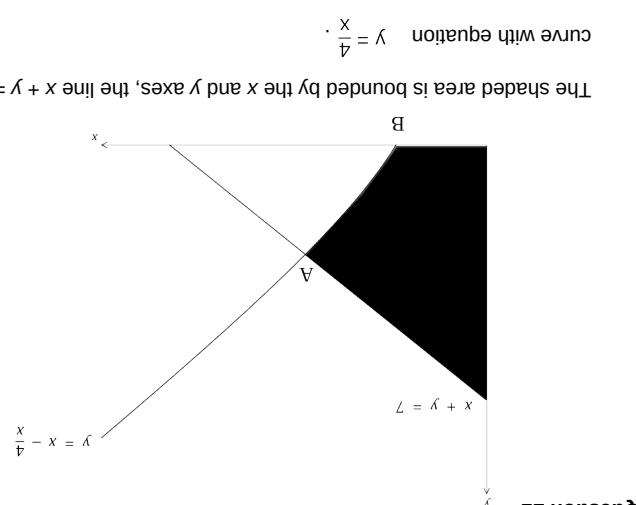
[2]

[2]

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- (b) State an expression, which when evaluated will determine the area of the shaded region. Give the area correct to two decimal places. [2]

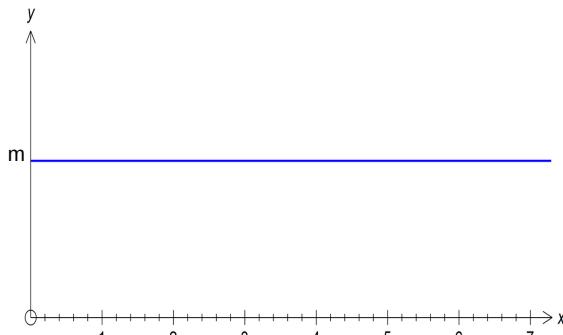
[6 marks]

**Question 21**

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Question 15**(4 marks)**

The probability density function for a continuous random variable, X , is given by the graph below.



- (a) Find the exact value of m .

[1]

- (b) Find the probability that X is less than 3.

[1]

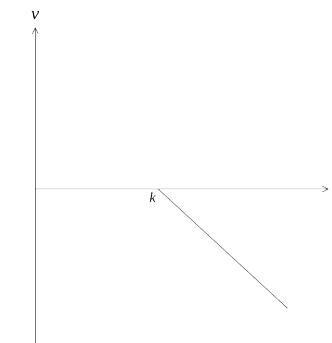
- (c) Given that X is less than 3, what is the probability that X is less than 2?

[2]

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After coming to rest, the object travels for a further three seconds with a velocity

given by $v = n - mt$, where $t > k$. This is represented on the axes given below.



- (d) State the expression, in terms of k , which represents the distance travelled in that three second period.

[2]

SECTION TWO

12

MATHEMATICS 3C3D
CALCULATOR ASSUMED
[8 marks]

Question 20

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SECTION TWO

9

(5 marks)

Question 16

In a survey taken in a football crowd, 30% of the crowd support West Coast.

- (a) Find the probability that in a random sample of 10 people:

(i) exactly 2 support West Coast.

(ii)

at most 4 support West Coast.

[1]

[1]

[2]

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Question 17

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(5 marks)

- (b) What is the size of the smallest sample of people for which the probability that 3 or more support West Coast, is at least 0.2.

[2]

- (iii) at least 3 do not support West Coast.

[1]

- (ii) at most 4 support West Coast.

[1]

(i) exactly 2 support West Coast.

[1]

(4 marks)

An object moves along a straight line, passing through point O with a velocity of 4 m/s. It has an acceleration, a ms $^{-2}$, given by $a = 16 - 2t$, t seconds after passing O. The object comes to rest when $t = k$ seconds.

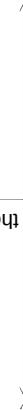
(a) Determine the maximum velocity of the object.

[2]

(b) Determine the exact value of k .

[2]

(c) Sketch the $v-t$ graph on the axes below, showing all key points. [2]



SECTION TWO**10****MATHEMATICS 3C3D
CALCULATOR ASSUMED**

In the Shakeshaft Building Company, 15% of the employees have attended a health and safety training course. Of the employees who have attended the training course, 75% are qualified to perform first aid, whereas of the employees who have not attended the training course only 20% are qualified to perform first aid.

- (a) What percentage of employees in the company are not qualified to perform first aid?

[3]

- (b) A randomly chosen employee is found to be qualified to perform first aid. What is the probability that she attended the training course? [2]

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SECTION TWO**11****MATHEMATICS 3C3D
CALCULATOR ASSUMED****Question 18****(4 marks)**

The velocity of a particle v cm/s, as it moves from rest along a straight line is given by $v = 8\sqrt{x}$ where x is its distance from the origin.

Show that if δx and δv denote corresponding small increases in x and v , then

$$\delta v \approx \frac{32}{v} \delta x$$

Hence find the approximate change in the velocity of the particle when x increases from 36 to 37 cm.

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Question 19 .**[4 marks]**

A new packing machine is being introduced into a sugar mill. It was found that the machine packs 500 gram bags of sugar is normally distributed with a mean 514g and standard deviation 12 grams. A batch of 1000 bags was packed on a given day.

- (a) How many of these bags would you expect to contain:

- (i) less than 500 grams of sugar,

[1]

- (ii) between 500 and 520 grams?

[1]

- (b) Calculate the 75-percentile for the entire population.

[2]

See Next Page