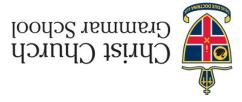
2016 UNIT TEST 4



to the supervisor before reading any further.

Important note to candidates

Section One: Section One:

Section One: Calculator-free

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Student name	:	

No other items 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

Instructions to candidates

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- Answer all questions.
- 3. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required 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.
- 4. It is recommended that you do not use pencil, except in diagrams.

(2 marks)	24 gol (d)		
(1 mark)	9 (8)		
$\cdot_{\mathcal{V}}$ bns x to smret in gniwollof	Let $\log \Sigma = x$ and $\log 3 = y$. Express each of the		Question number:
(5 marks)	↑ noitesuΩ		Additional working space
MATHEMATICS METHODS Year 12	CALCULATOR-FREE 3	CALCULATOR-ASSUMED	MATHEMATICS METHODS Year 12 8

 $\overline{8}.0\,\mathrm{gol}$ (c)

(z marks)

CALCULATOR-ASSUMED

Question 2 (6 marks)

(a) Solve the equation $3^{(x-1)} = 15$, leaving your answer in exact values. (2 marks)

(b) Solve the equation $2\log_x\left(\frac{1}{32}\right) = -5$.

(2 marks)

(c) Differentiate $\log_5(x^2)$ with respect to x.

(2 marks)

Question 8 (5 marks)

7

(a) A health care provider was considering a study of children in Australia who had suffered from influenza. After defining their target population, 6800 children who met the criteria were identified through available medical records. Clearly explain the steps involved in using systematic sampling to select a random sample of 400 of these children. (2 marks)

(b) 50 tagged trout were released into a lake. Over weekly intervals, small samples of trout were caught from various locations around the lake, with the following results

	Number of trout in sample	Percentage of sample tagged
Week 1	40	5%
Week 2	20	10%
Week 3	50	4%

Use the capture-recapture method to estimate the number of trout in the lake.

(2 marks)

(c) X is a continuous random variable which follows a uniform distribution for $2 \le x \le 9$. That is, $X \sim U[2, 9]$.

Write a ClassPad function to simulate a value for *X*.

(1 mark)

(2 marks)

(b) Find E(X), the expected value of X. (c) marks) (b) $\int \frac{12-20x}{5x^2-6x+1} \, dx$

(c) Find the standard deviation of X.

(d) Determine P(3 < X < 5).

MATHEMATICS METHODS Year 12	6	CALCULATOR-FREE
Additional working space		

Question number: _____

CALCULATOR-ASSUMED 5 MATHEMATICS METHODS Year 12

Question 6 (7 marks)

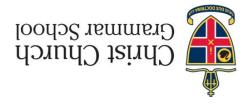
Clay Fishe, owner of a yabbie farm, has found that the distribution of weights of his yabbies is symmetrical, with approximately 68% of his yabbies weighing between 40 g and 66 g, and a further 13.5% of his yabbies weighing between 27 g and 40 g.

(a) State the appropriate distribution (with its parameters) for the weight of yabbies at Clay's farm. Justify your choice of distribution. (3 marks)

(b) What proportion of Clay's yabbies are above the market weight of 30 g? (2 marks)

(c) Yabbies increase in size by an average of 3 g per month. How many months will Clay have to wait so that at least 99% of his current stock will be above the market weight of 30 g? (2 marks)

2016 UNIT TEST 4



to the supervisor before reading any further.

MATHEMATICS METHODS Year 12

Section 1 wo: Calculator-assumed

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CALCULATOR-ASSUMED

Question 5 (7 marks)

MATHEMATICS METHODS Year 12

An intersection is controlled by a set of traffic lights. The traffic lights are timed so that the lights will be green for 20 seconds, and then red for 100 seconds. Motorist Di Hatsoo passes through these traffic lights each day on her way to and from work. The time that she arrives at these traffic lights on any given day is random and independent of travel on any other day.

Assuming that the lights are red when Di arrives at the intersection, and ignoring any delays caused by traffic or road conditions, the amount of time (T seconds) that Di has to wait at these lights can be modelled by a uniform distribution.

- (a) State the probability density function for T. (2 marks)
- Determine the probability that, on any given that she has to wait for at least one intersection for less than 90 seconds, given that she has to wait for at least one minute. (2 marks)
- c) What is the mean waiting time for Di on the days that she arrives at the intersection when the lights are red? (2 marks)
- If the assumption that Di arrived at the intersection when the lights are red was
 removed, would it still be appropriate to model Di's waiting time using a uniform
 distribution? Justify your answer.
 (1 mark)

See next page

MATHEMATICS METHODS Year 12

2

CALCULATOR-ASSUMED

CALCULATOR-ASSUMED

MATHEMATICS METHODS Year 12

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Question 4 (4 marks)

3

Chemists define the acidity or alkalinity of a substance according to the formula: $pH = -log[H^+]$ where $[H^+]$ is the hydrogen ion concentration, measured in moles/litre. Solutions with a pH value of less than 7 are acidic, solutions with a pH value greater than 7 are basic, and solutions with a pH of 7 (such as pure water) are neutral.

(a) The hydrogen ion concentration of apple juice is $[H^+] = 0.000$ 28. Find the pH value, rounded correct to 2 decimal places, and hence determine whether the juice is basic or acidic. (2 marks)

(b) An unknown mixture is tested and found to have a pH value of 9.7. What is the hydrogen ion concentration of the unknown mixture? Write your answer in scientific notation, rounded correct to 3 significant figures. (2 marks)