L7   **SEMESTER TWO**

YEAR 11

MATHEMATICS METHODS
Units 1 & 2
2016

REVISION 2
Section Two
(Calculator–assumed)

Name: _____

Teacher: _____

TIME ALLOWED FOR THIS SECTION

Reading time before commencing work: 10 minutes

Working time for section: 100 minutes

MATERIAL REQUIRED / RECOMMENDED FOR THIS SECTION

To be provided by the candidate
Standard items*:* pens, pencils, pencil sharpener, highlighter, eraser, ruler.

Special items: drawing instruments, templates, notes on up to two unfolded sheets of A4 paper, and up to three calculators approved for use in examinations.

IMPORTANT NOTE TO CANDIDATES
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 to the supervisor before reading any further.

To be provided by the supervisor
Question/answer booklet for Section Two.
Formula sheet retained from Section One.

Structure of this examination

	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One Calculator—free	7	7	50	52	35
Section Two Calculator—assumed	**11**	**11**	**100**	**98**	**65**
Total marks				150	

Instructions to candidates

1.　The rules for the conduct of this examination are detailed in the Information Handbook. Sitting this examination implies that you agree to abide by these rules.

2.　Write your answer in the Question/Answer booklet.

3.　You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

4.　Spare 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.

5.　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.

6.　It is recommended that you do not use pencil, except in diagrams.

7.　The Formula Sheet is not to be handed in with your Question/Answer booklet.

Section Two: Calculator–assumed   **98 marks**

This section has **thirteen (13)** questions. Attempt **all** questions.
Working time: 100 minutes

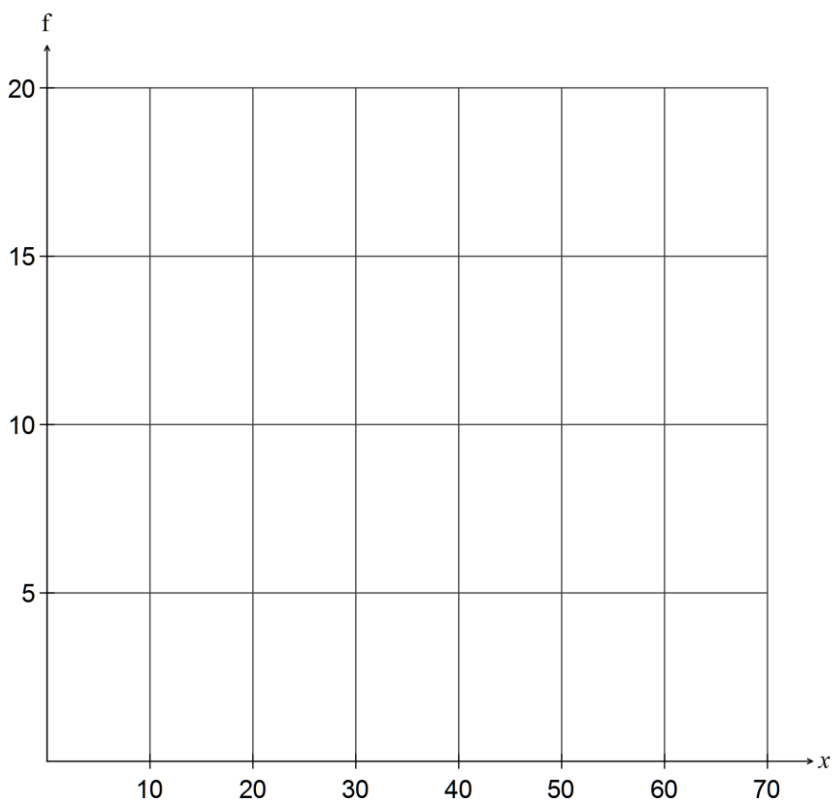**Question 8**   **(5 marks)**

(a)   A football is kicked and follows the path $f(x) = -0.02x^2 + 1.2x + 1$ where distances are in metres.

     (i)   How far does the football travel before it bounces on the ground?   (2)

     (ii)   How high does the football go?   (1)

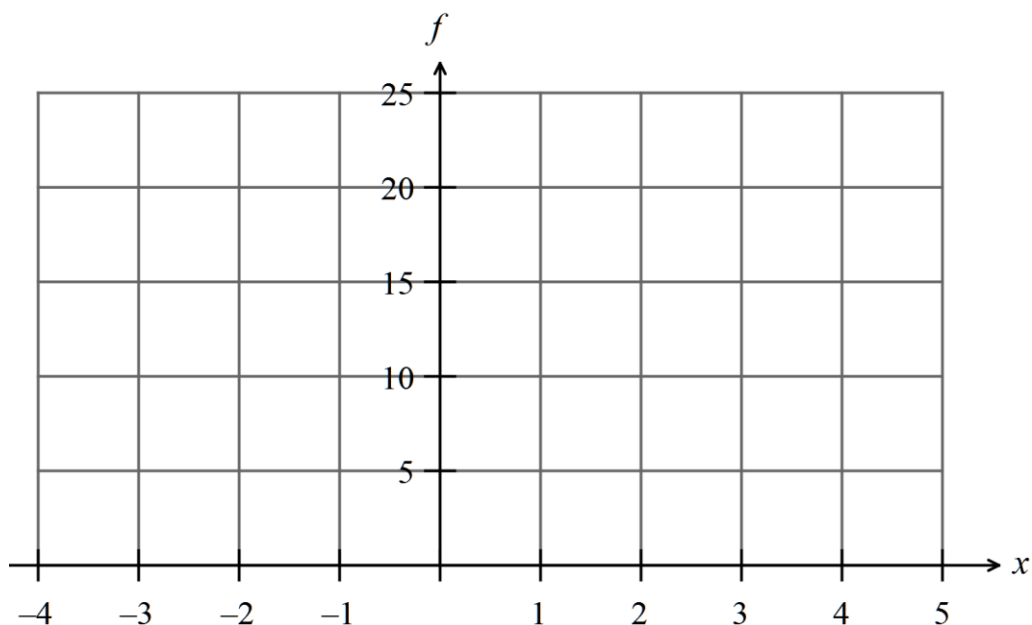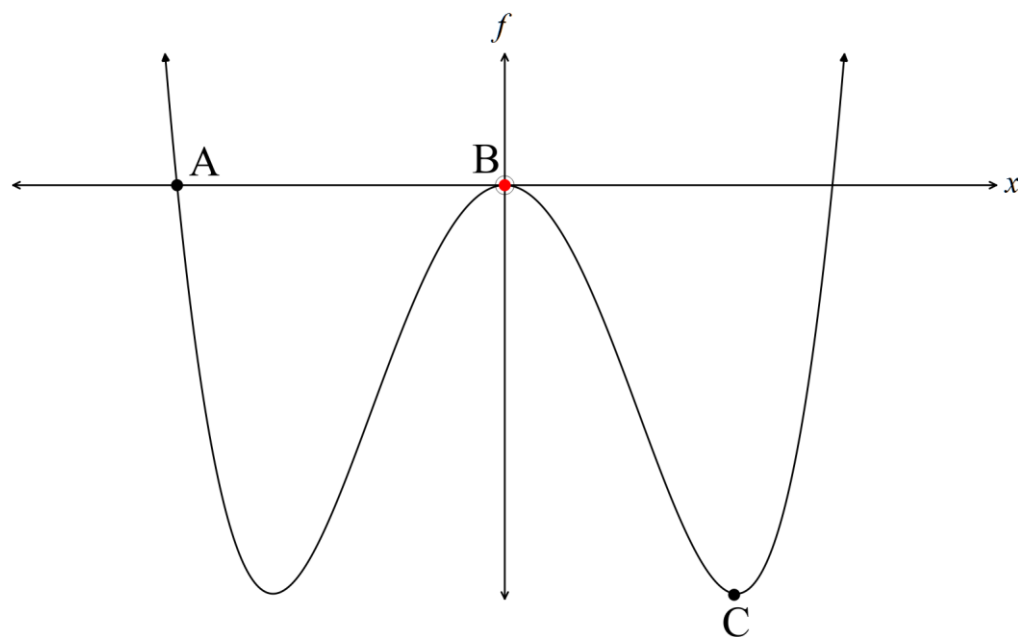   (ii)   <u>Sketch</u> the path of the football on the set of axes below.   (2)

Question 9   **(10 marks)**

(a)   Graph a function that has the following properties on the set of axes below.   (4)

x	-3	-2	0	0.5	3	4
f		2	20	22	2	
f'	-	0	+	0	0	+

(b)   The diagram below shows the function $f(x) = x^4 - 9x^2$.

(i)   Find the coordinates of point A.   (2)

(ii)   Describe point B.   (2)

(iii) Find the x ordinate of C.
       NB You do not have to find y value for C.   (2)

_____

Question 10   **(14 marks)**

The initial position of a particle is zero.
The particle has velocity $v = 6 - 6t\ m/s$ defined for $t \geq 0$.
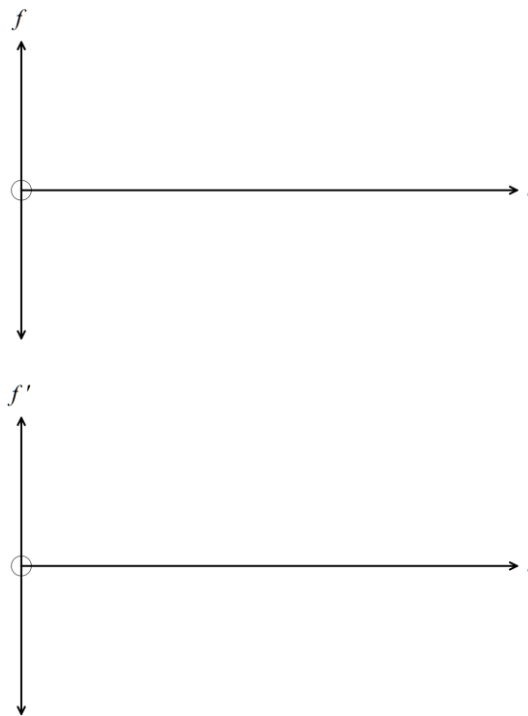
(a)   Determine an expression for the position of the particle at time t.   (3)

(b)   Determine the position of the particle when it changes direction.   (2)

(c)   Find the speed at $t = 2$.   (2)

_____

(d)   Sketch the positon function and the velocity functions on the set of axes below.

(4)

f

t

f'

t

(e)   Comment on the relationship between the graphs of f and f '.   (3)

Question 11   **(6 marks)**

Consider the function $y = x^2 - 4$.
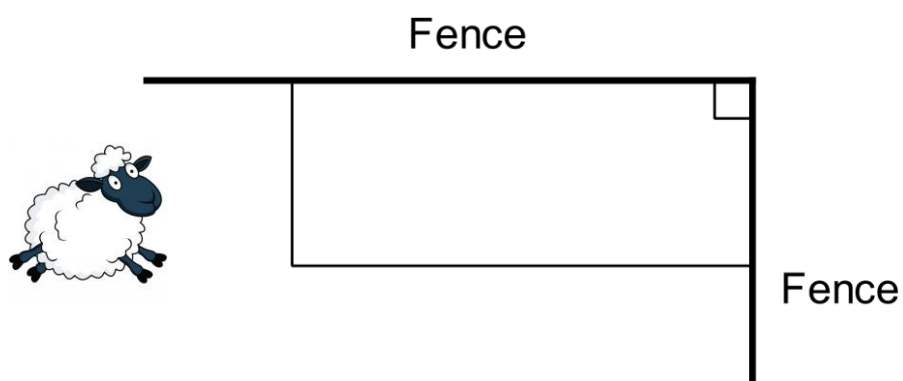
(a)   Determine the point on the function where the tangent has a slope of 3.   (3)

(b)   Find the equation of the tangent at this point.   (2)

(c)   Write down the slope of the normal at this point.   (1)

Question 12   **(6 marks)**

A farmer wants to construct a rectangular sheep pen for a sick sheep in the corner of the sheep paddock. The corner is made of two fences that meet at right angles.

The farmer has 10m of fencing to make the pen.

Use a calculus method to find the dimensions of the pen that maximise the area for the sick sheep.   (6)

Question 13   **(12 marks)**

(a)   A circle of radius 5 cm has a segment cut off by a chord of length 8 cm.
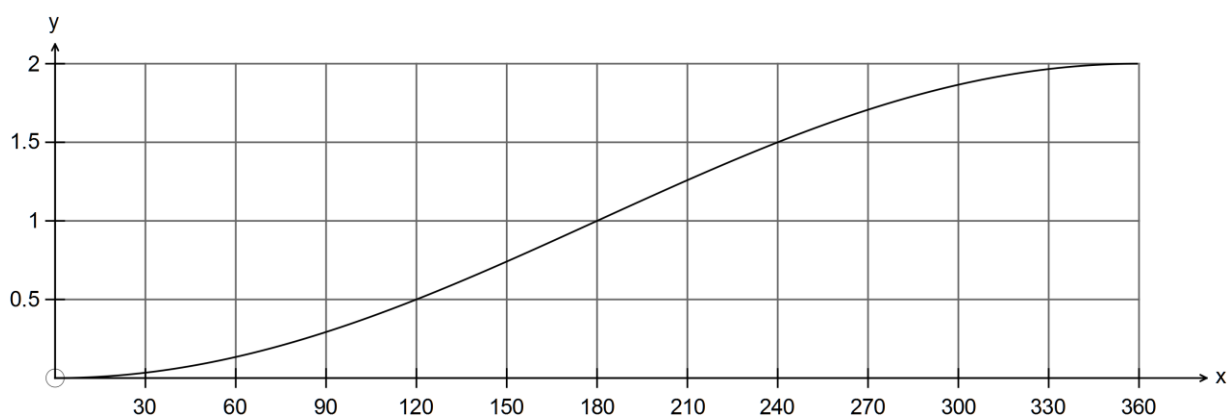   Find the area of the segment.   (2)

(b)   Solve for x

   (i) $sin\left(\dfrac{x}{2}\right) = \dfrac{1}{\sqrt{2}}$ for $-\dfrac{\pi}{2} \le x \le \pi$ (2)
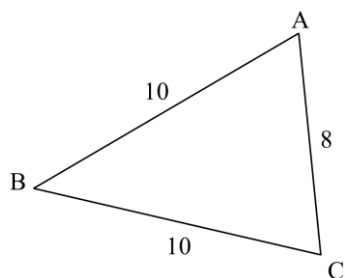
   (ii) $tan\left(2x + \dfrac{\pi}{3}\right) = -\sqrt{3}$ for $0 \le x \le \dfrac{\pi}{2}$ (2)

(c)   Use the expansion of $\cos(x+y)$ to find an expression for $\cos\left(\dfrac{7\pi}{12}\right)$.   (2)

(d)   Determine the equation of the function graphed below   (2)

(e)   Find the area of the triangle ABC below.   (2)

Question 14   **(10 marks)**

(a)   A population of mice established itself in Jack's garage and being a soft-hearted man, he left them there. What Jack didn't know, was that populations of mice grew exponentially!

He had noticed they had had babies and there were 5 mice altogether.

Let P represent the population of mice. It is known that mice double their population every six months. Let P_0 be the initial population.

(i)   Write down a formula that can be used to predict the mouse population in t years time.

(1)

(ii)   How many mice will there be in the garage in two years time?   (2)

If the population of mice exceeds 25, the garage will be too small and the mice will try to enter the house.

(iii)   When is this expected to happen?   (2)

(b)   Evaluate $1\dfrac{1}{4}+2\dfrac{1}{8}+3\dfrac{1}{16}+....$ correct to 10 terms.   (5)

Question 15   **(4 marks)**

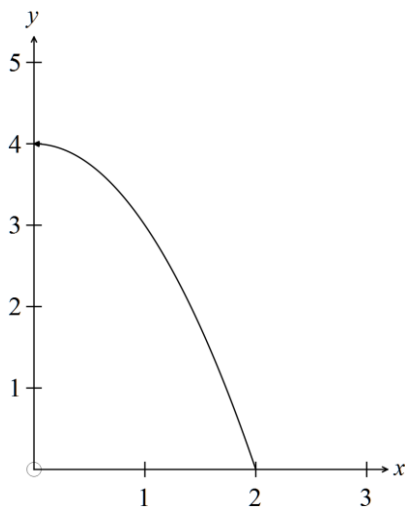(a)   Differentiate

     (i) $y = 3 - 4x^3 + 6x$ (2)

     (ii) $f(x) = -4\left(2 - x^3\right)$ (2)

Question 16   **(9 marks)**

(a)   The function $f(x) = 4 - x^2$ is shown on the diagram below.

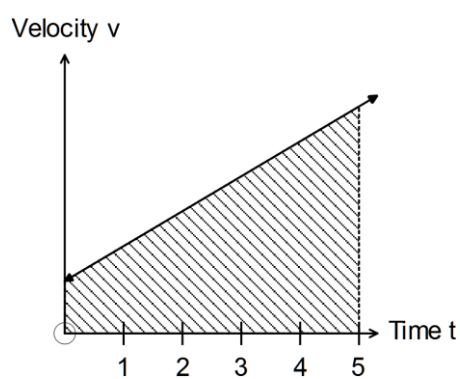(i)   Evaluate $\dfrac{f(x+h) - f(x)}{h}$ where $x = 1$ and $h = 0.1$ (3)

(ii)   Interpret what you have found in (i)   (2)

(iii)   Explain the difference between the average rate of change on an interval and the instantaneous rate of change at a point.   (2)

(b)   Given the velocity time graph below,

Velocity v

explain what the shaded area represents.   (2)

Question 17   **(11 marks)**
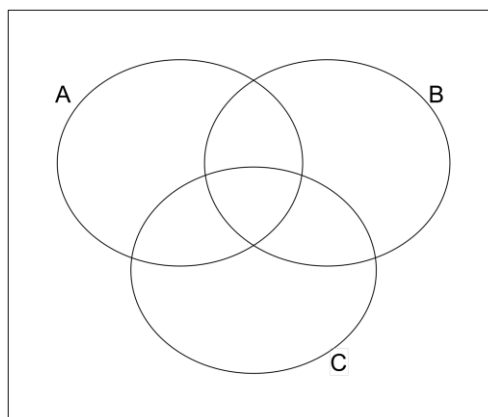
(a)   If $P(A) = 0.2, \ P(B) = 0.4, \ P(\overline{A \cup B}) = 0.5$ determine

     (I)   if A and B are independent.   (3)
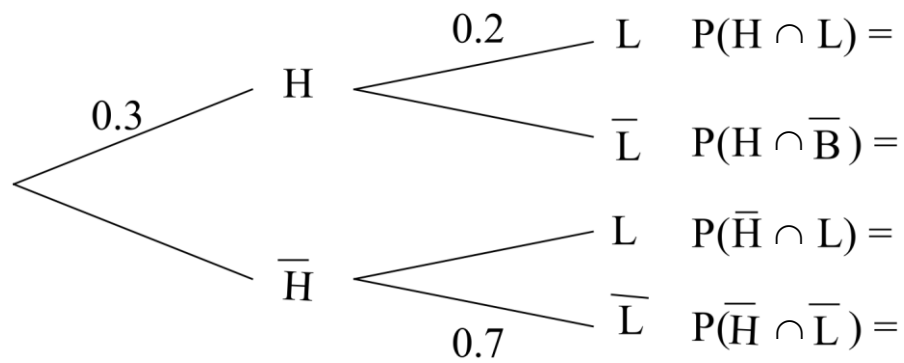
     (ii)   if A and B are mutually exclusive.   (1)

(b)   Shade $\left(A \cap \overline{B}\right) \cup C$ on the Venn diagram below.   (2)

(c)   (i)   Complete the tree diagram below.

$$0.2 \quad L \quad P(H \cap L) =$$

$$H$$

$$0.3$$

$$\overline{L} \quad P(H \cap \overline{B}) =$$

$$L \quad P(\overline{H} \cap L) =$$

$$\overline{H}$$

$$0.7 \quad \overline{L} \quad P(\overline{H} \cap \overline{L}) =$$

(2)

(ii)   Find $P(L)$ (1)

(iii)   Find $P(H \mid \overline{L})$ (2)

Question 18   **(11 marks)**

Ruth was very superstitious. When learning to drive, she drove 5 km the first day, 7 the second day, 9 the third day and so on.

She believed that she needed to drive at least 200 km before she would pass the test.

(a)   If this were true, how many days did Ruth need to go out and drive?   (5)

Ruth's mother said she must have at least 10 lessons, with one lesson a day during her holidays. Ruth insisted on her method of driving only two kms more than on the previous day and only driving 5 km on the first day.

(b)   How far will she have driven after ten lessons?   (3)

In fact Ruth had driven 480 kms before she went to try for her license

(c)   how many lessons did she take?   (3)

END OF SECTION TWO