

91262



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SUPERVISOR'S USE ONLY

# Level 2 Mathematics and Statistics, 2017

## 91262 Apply calculus methods in solving problems

2.00 p.m. Friday 24 November 2017  
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Apply calculus methods in solving problems.	Apply calculus methods, using relational thinking, in solving problems.	Apply calculus methods, using extended abstract thinking, in solving problems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

Make sure that you have Formulae Sheet L2–MATHF.

Show ALL working.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

**You must show the use of calculus in answering all questions in this paper.**

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

TOTAL

ASSESSOR'S USE ONLY

**QUESTION ONE**

- (a) A function  $f$  is given by  $f(x) = x^5 + 3x^2 - 7x + 2$ .

Find the gradient of the graph of the function at the point where  $x = 1$ .

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- (b) Find the equation of the tangent to the graph of the function

$$f(x) = 6 + 14x - 2x^3$$

at the point  $(2, 18)$  on the graph.

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- (c) The movement of an object is recorded from the time it passes a fixed point. After  $t$  seconds it has a speed  $v$  m s<sup>-1</sup>, which can be modelled by the function

$$v(t) = 0.5t^2 - 2t + 1$$

Use calculus to find how long it takes to reach an acceleration of 2.8 m s<sup>-2</sup>.

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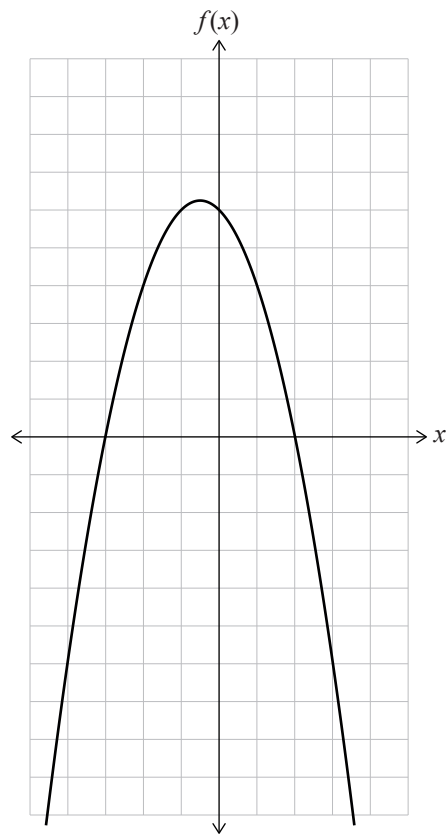
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## QUESTION TWO

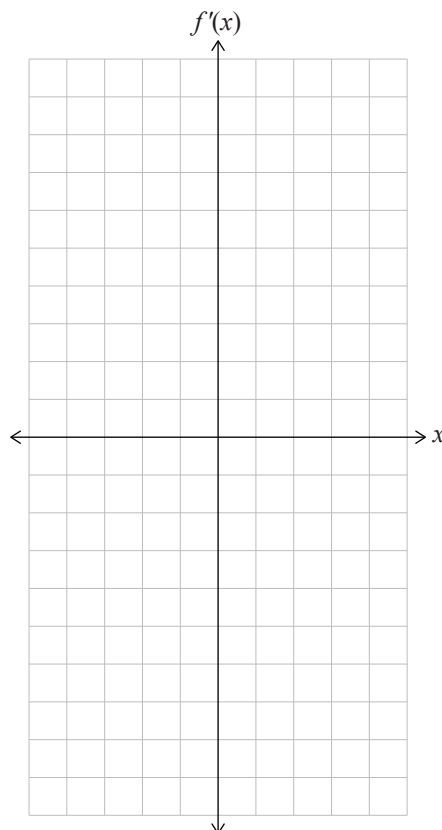
ASSESSOR'S  
USE ONLY

- (a) The diagram below shows the graph of the function  $y = f(x)$



Sketch the graph of the gradient function  $y = f'(x)$  on the axes below.

Both sets of axes have the same scale.



*If you need  
to redraw this  
graph, use the  
grid on page 11.*



- (e) Use calculus to prove that the graph of the function

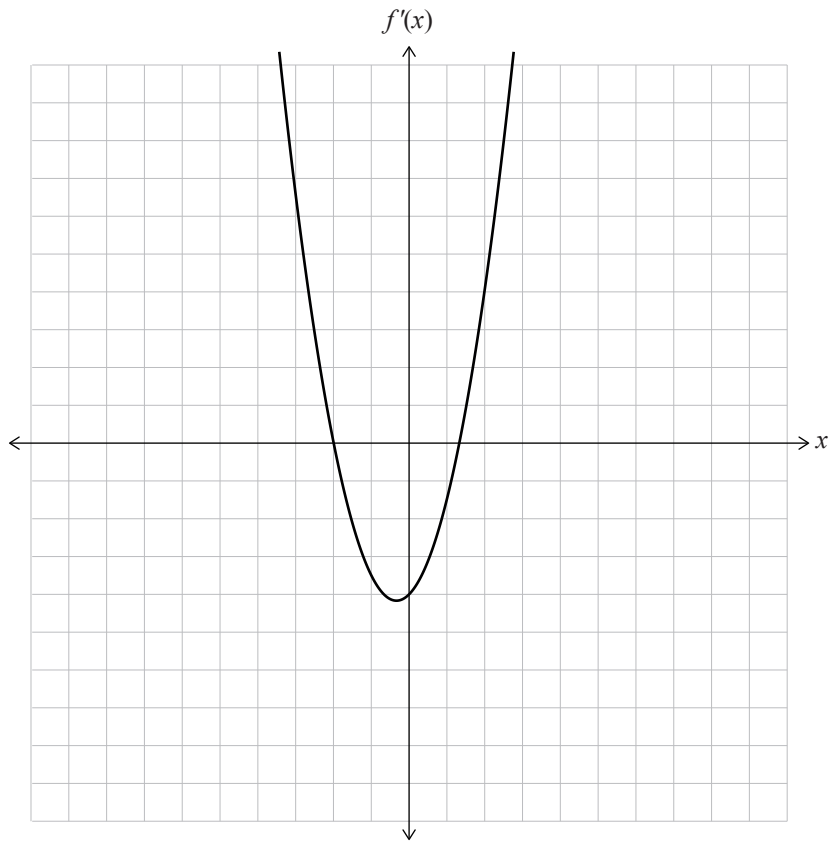
$$y = x^3(3 - x)$$

has a local maximum when  $x = \frac{9}{4}$ .

Justify that the turning point is a local maximum.



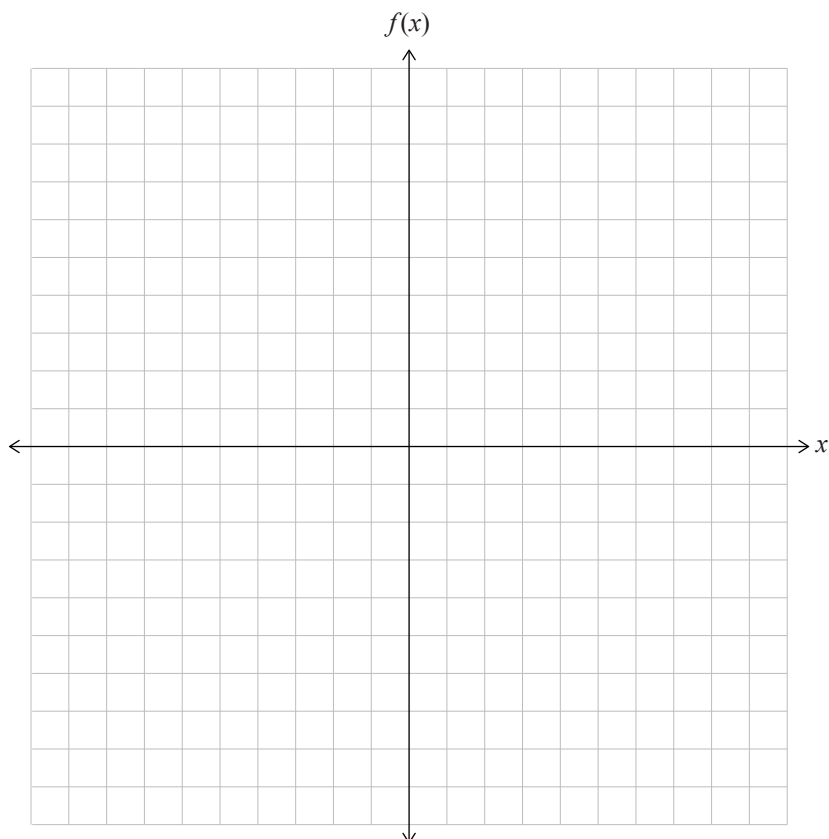
- (b) The diagram below shows the graph of a gradient function  $y = f'(x)$ .



The point  $(0,0)$  is on the graph of the function  $y = f(x)$ .

On the axes below sketch the function  $f(x)$ .

Both sets of axes have the same scale.



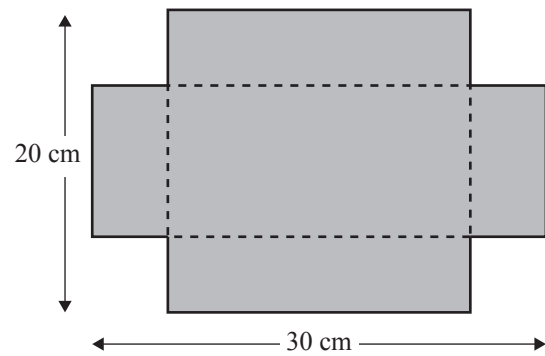
*If you need to redraw this graph, use the grid on page 11.*





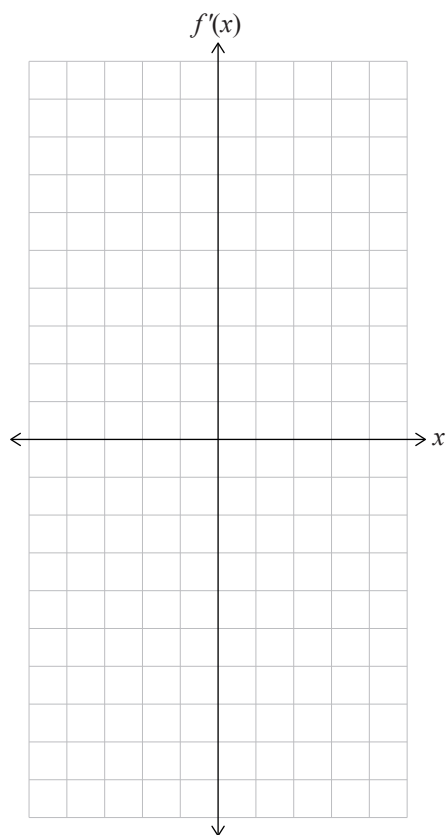
- (d) Find the maximum volume of an open box (i.e. a box with a base and sides, but no lid) that can be made from a rectangular piece of cardboard measuring 20 cm by 30 cm, by removing the corner squares and folding along the dotted lines.

Justify that this is the maximum volume.



**SPARE GRIDS**

If you need to redraw your graph from Question Two (a), draw it on the grid below. Make sure it is clear which answer you want marked.



If you need to redraw your graph from Question Three (b), draw it on the grid below. Make sure it is clear which answer you want marked.

