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2

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

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QUESTION ONEASSESSOR'S
USE ONLY

- (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 $x = 1$.

- (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.

- (c) The movement of an object is recorded from the time it passes a fixed point.

After t seconds it has a speed $v \text{ m s}^{-1}$, 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^{-2} .

- (d) A tangent to the graph of the function $f(x) = 3x^2 - 4x$ has a gradient of 2, and passes through the point $(5, a)$, where a is a constant.

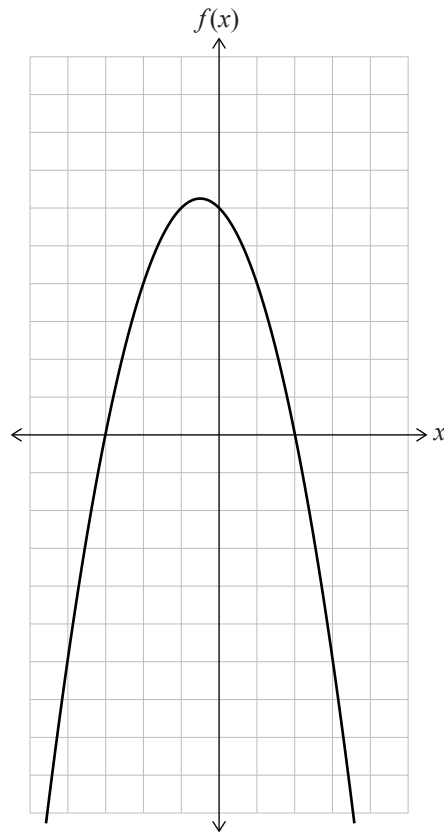
Find the value of a .

- (e) The function $f(x) = x^3 + ax^2 + bx + 2$ has turning points when $x = -1$ and $x = 3$.

Find the values of a and b .

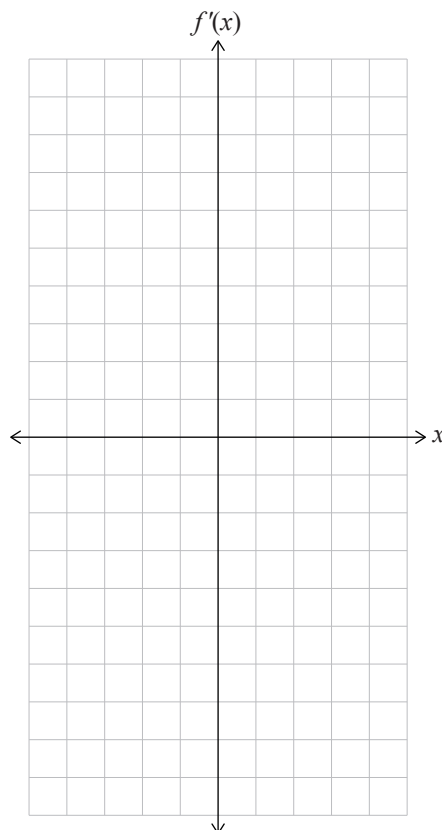
QUESTION TWO

- (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.

- Find the value of b .

- There is more space for your

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- (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.

QUESTION THREEASSESSOR'S
USE ONLY

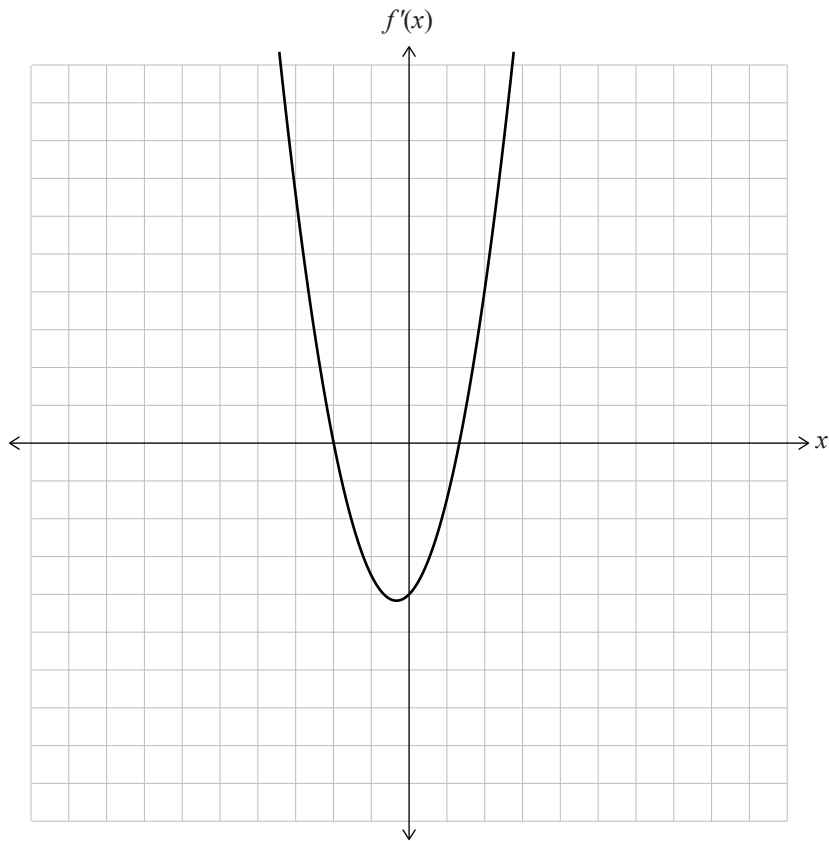
- (a) The gradient graph of a function $f(x)$ is given by

$$f'(x) = 6x^2 - 2x + 4$$

The point (1,3) lies on the graph.

Find the equation of the function $f(x)$.

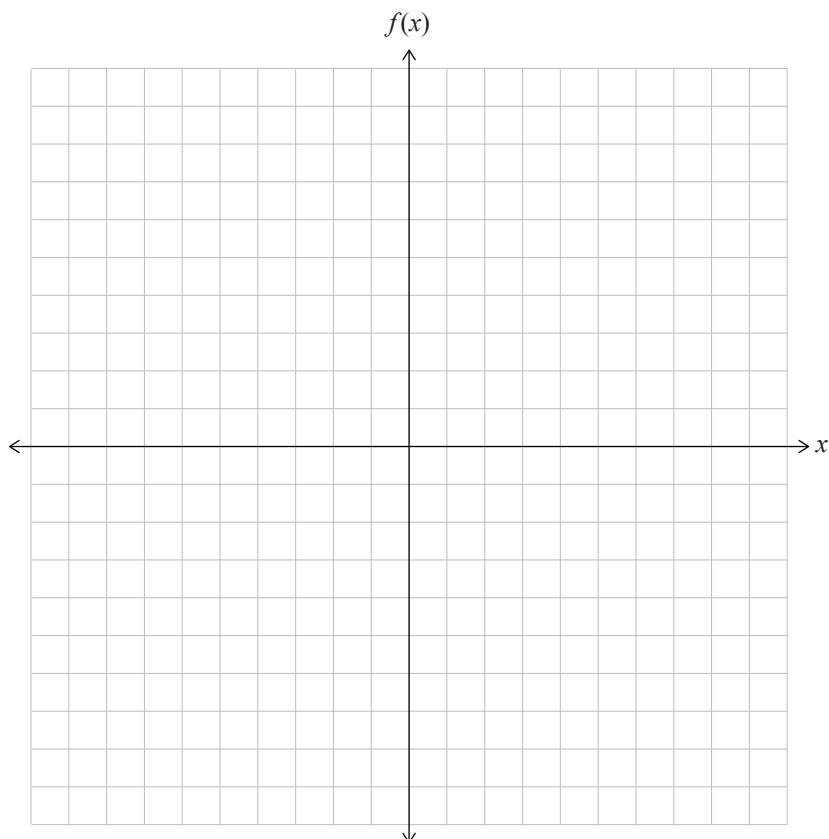
- (b) The diagram below shows the graph of a gradient function $y = f'(x)$.



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.*

- A fixed point P is marked on the track.

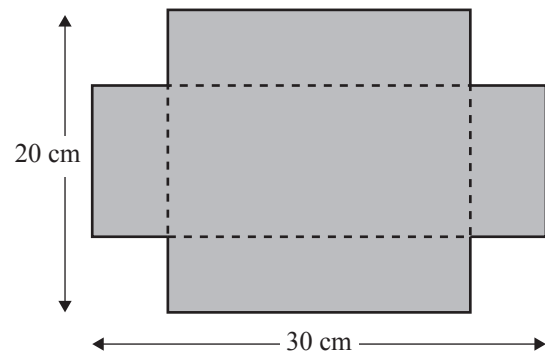
- is 12 cm from P
- is moving away from P, and
- has a velocity of 6 cm s^{-1} .

- Justify that this is the maximum distance.

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- (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.

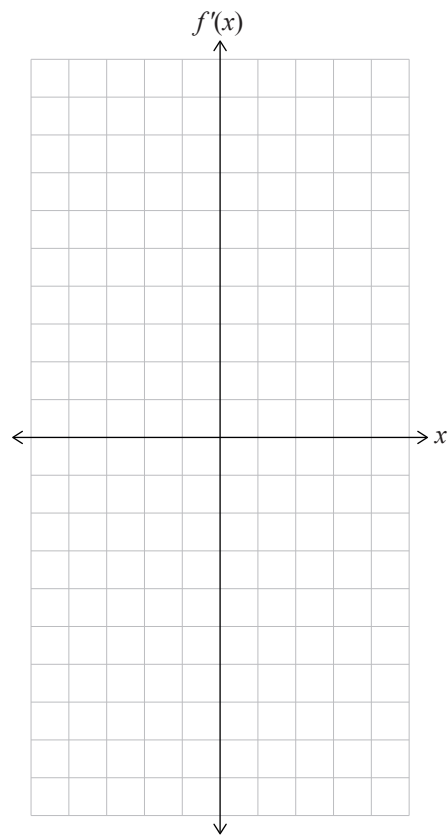
Justify that this is the maximum volume.



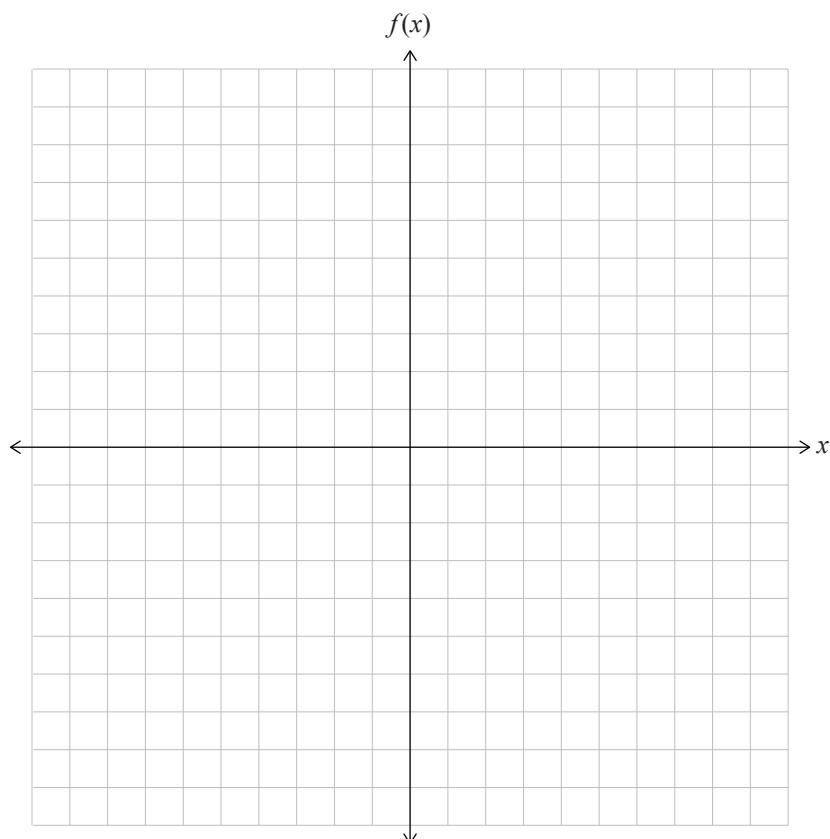
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SPARE GRIDSASSESSOR'S
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If you need to redraw your graph from Question Two (a), draw it on the grid below. Make sure it is clear which answer you want marked.



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.



Extra paper if required.
Write the question number(s) if applicable.

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QUESTION
NUMBER

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