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NEW ZEALAND QUALIFICATIONS AUTHORITY
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2

SUPERVISOR'S USE ONLY

Level 2 Mathematics and Statistics, 2018

91262 Apply calculus methods in solving problems

9.30 a.m. Wednesday 14 November 2018
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 2–15 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 ONEASSESSOR'S
USE ONLY

- (a) A function f is given by $f(x) = x^3 - 6x + 2$.

Find the gradient of the graph of the function at the point where $x = 4$.

- (b) A rectangle is expanding in area so that at all times its length is three times its width.

Find the rate of change of the area of the rectangle with respect to its width when the area of the rectangle is 75 cm^2 .

- (c) The derivative of a function f is given by $f'(x) = -3x^2 + 12x$.

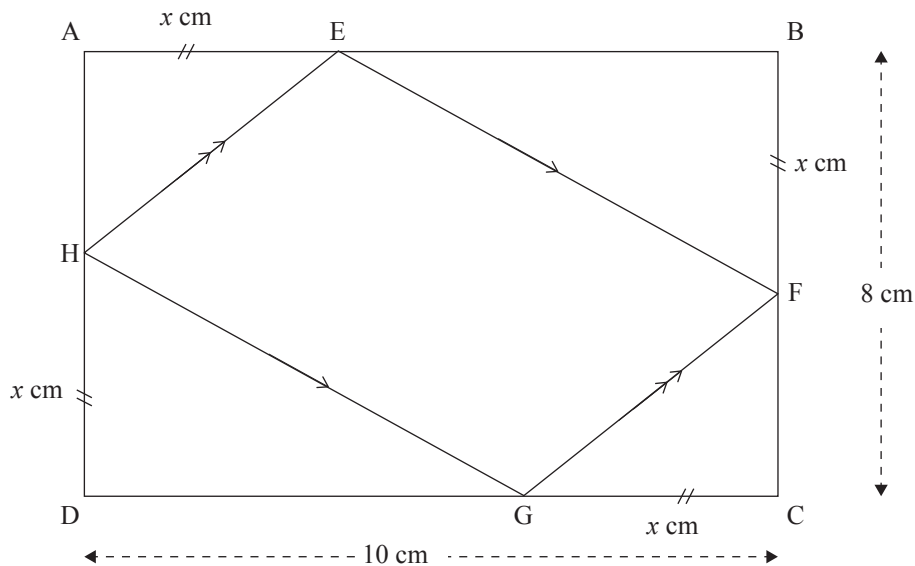
The graph of the function has a local minimum at the point $(0,5)$.

Use calculus to find the value of the local maximum of the function.

- (d) Use calculus to find the values of x for which the graph of the function

$$f(x) = \frac{2}{3}x^3 + \frac{9}{2}x^2 - 5x - 18$$
 is increasing.

- That is, $AE = BF = CG = DH = x$.

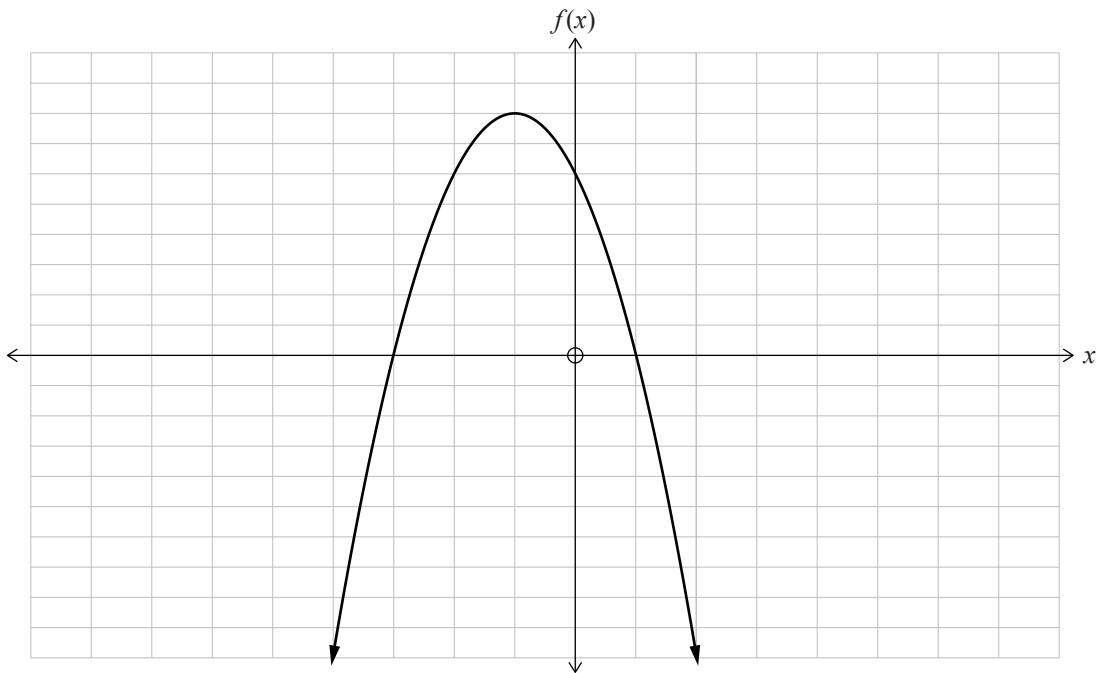


Justify that your answer is a minimum.

QUESTION TWO

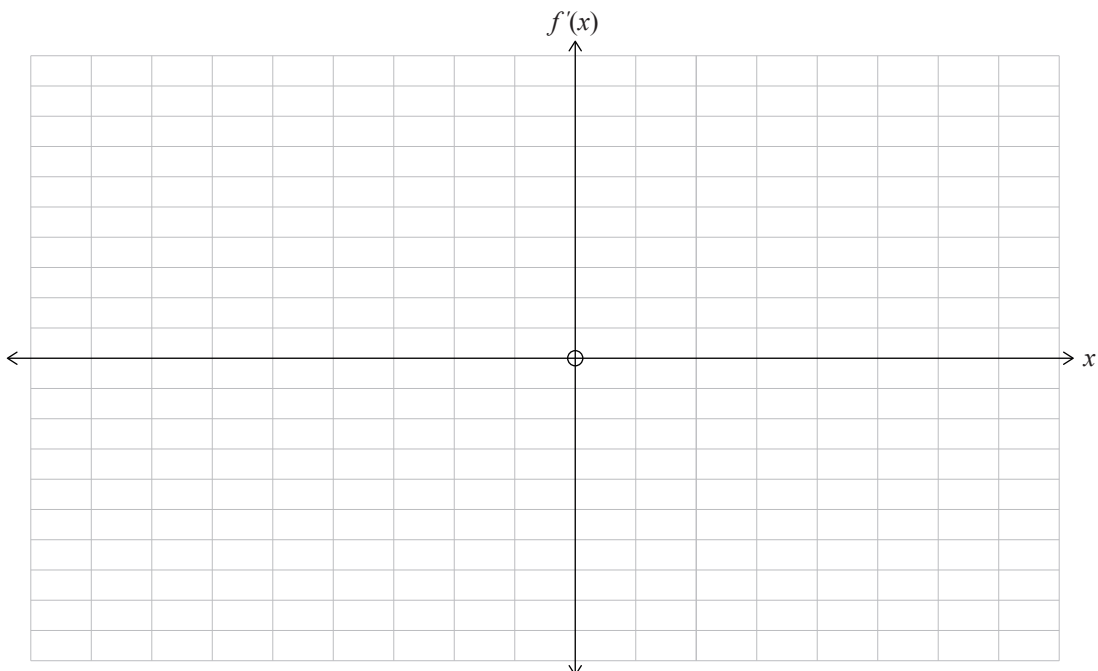
ASSESSOR'S
USE ONLY

- (a) The graph of a function $y = f(x)$ is shown on the axes below.



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

Both sets of axes have the same scale.

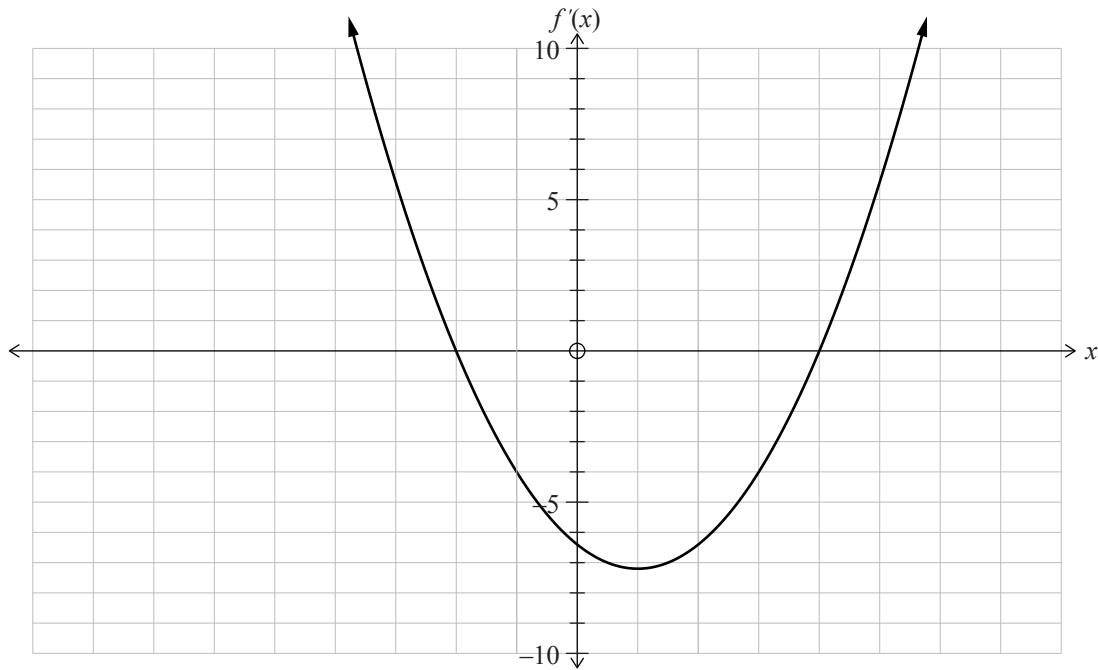


*If you need to
redo this question
part, use the grids
on page 12.*

- $$h(t) = 39.2t - 4.9t^2.$$

- $$a(t) = 6 - 12t.$$

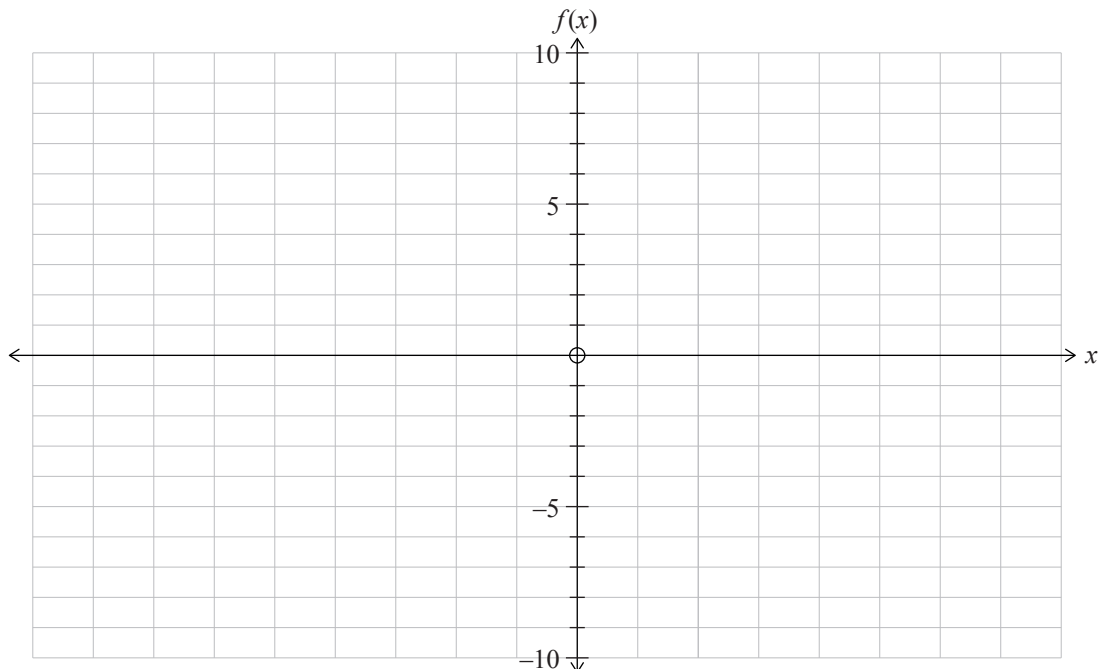
- (d) The diagram below shows the graph of the gradient function $y = f'(x)$ of a function $y = f(x)$.



The graph of the function $y = f(x)$ passes through $(0, 3)$.

On the axes below sketch the graph of the function f .

Both sets of axes have the same scale.



If you need to redo this question part, use the grids on page 13.

- Determine the nature of each turning point, justifying your answer.

QUESTION THREEASSESSOR'S
USE ONLY

- (a) The gradient function of a curve is given by $\frac{dy}{dx} = -5x^4 + 6$.

The curve passes through (1,7).

Find the equation for y .

- (b) Suppose that, at the start of a particular day, 1000 people were trading in a market, and that t days after the start of that day, the number of traders, N , can be modelled by

$$N(t) = 1000 + 400t + 100t^2.$$

How many days will it take for the rate of change of the number of traders to be 14 400 per day?

**Question Three continues
on the following page.**

- The revenue, $\$R$, from selling tickets for a price of $\$p$ each, can be modelled by the function

Use calculus to find the maximum possible revenue (using this model).

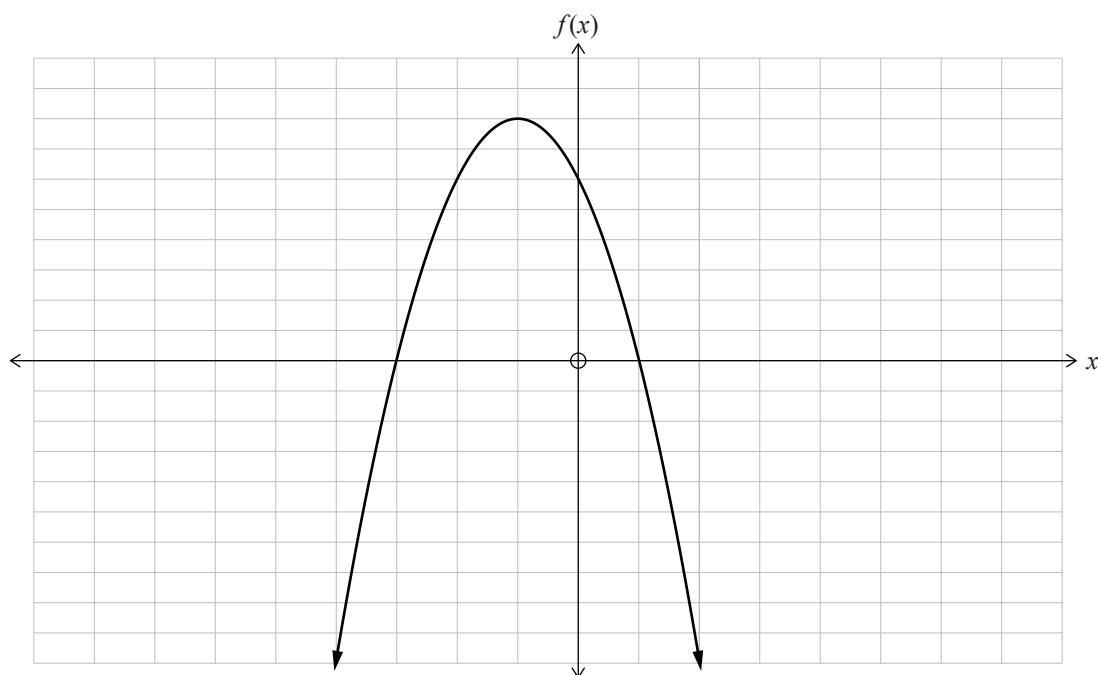
- Use calculus to find the co-ordinates of the point P.

SPARE GRIDSASSESSOR'S
USE ONLY

If you need to redo Question Two (a), use the grid below. Make sure it is clear which answer you want marked.

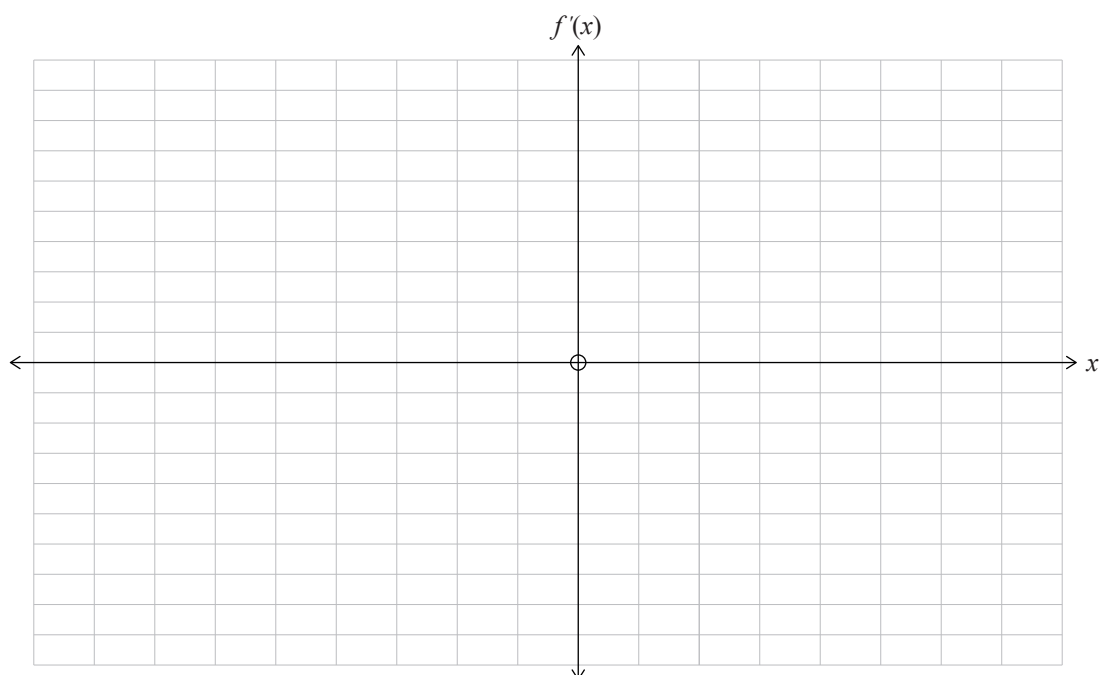
QUESTION TWO

- (a) The graph of a function $y = f(x)$ is shown on the axes below.



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

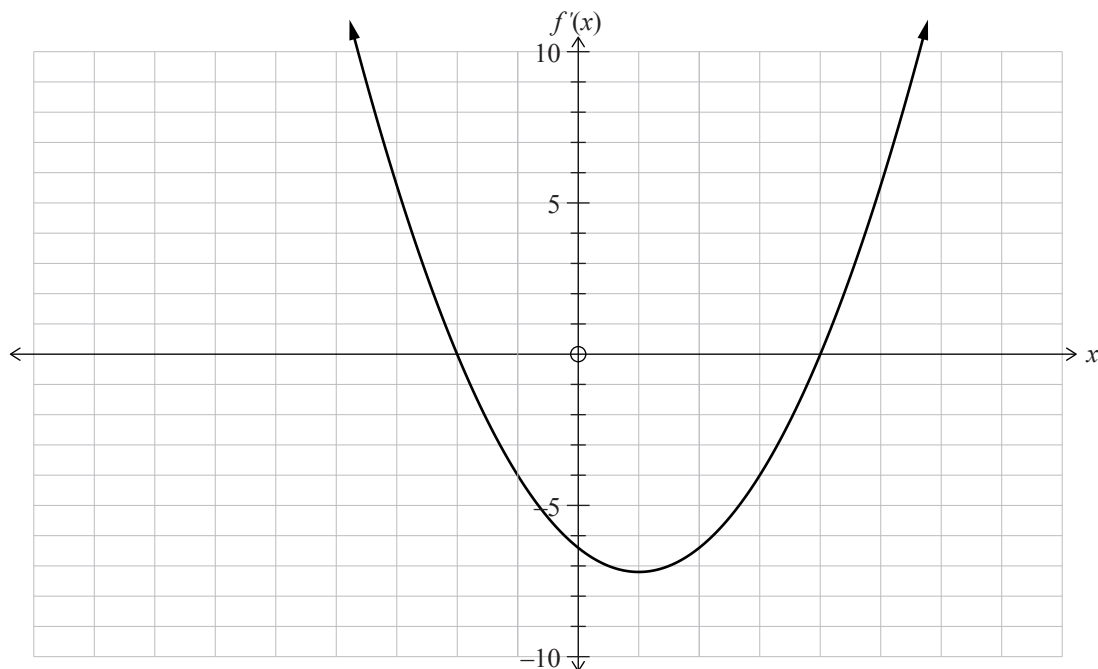
Both sets of axes have the same scale.



If you need to redo Question Two (d), use the grid below. Make sure it is clear which answer you want marked.

QUESTION TWO

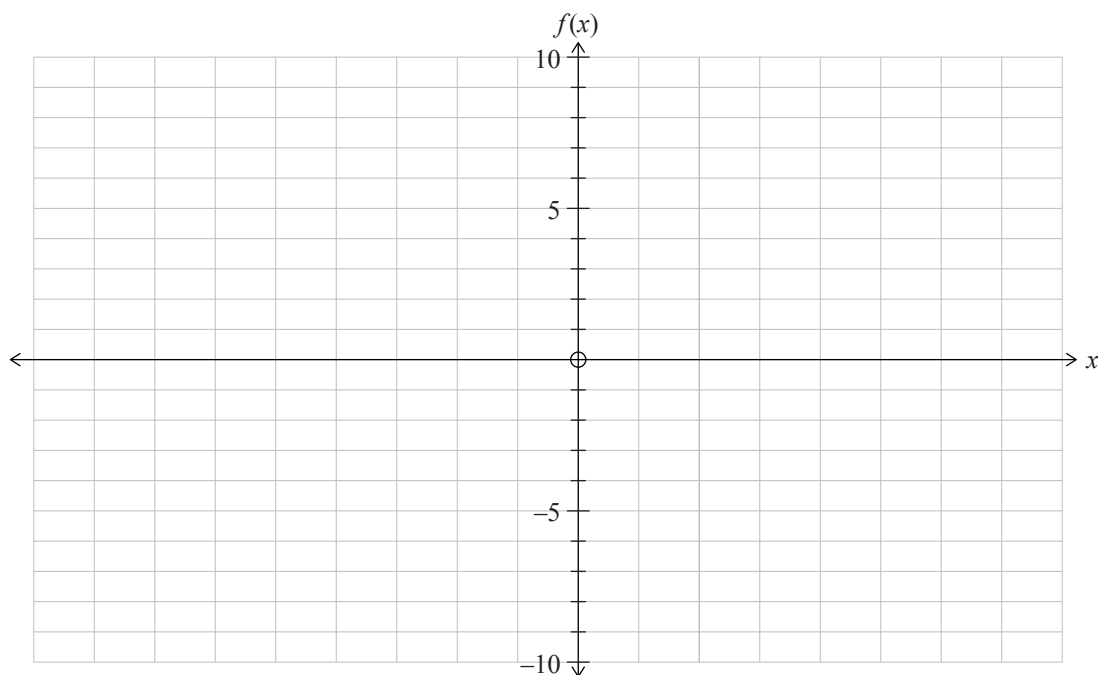
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Both sets of axes have the same scale.



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

QUESTION
NUMBER

ASSESSOR'S
USE ONLY

Extra space if required.
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QUESTION
NUMBER

ASSESSOR'S
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