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NEW ZEALAND QUALIFICATIONS AUTHORITY
 MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
 KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Level 3 Calculus, 2016

91578 Apply differentiation methods in solving problems

9.30 a.m. Wednesday 23 November 2016
 Credits: Six

Achievement	Achievement with Merit	Achievement with Excellence
Apply differentiation methods in solving problems.	Apply differentiation methods, using relational thinking, in solving problems.	Apply differentiation 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.

Show ALL working.

Make sure that you have the Formulae and Tables Booklet L3–CALCF.

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

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) Differentiate $y = 1 + x - \frac{1}{x} + \frac{1}{x^2}$.

- (b) The height of the tide at a particular beach today is given by the function

$$h(t) = 0.8 \sin\left(\frac{4\pi}{25}t + \frac{\pi}{2}\right)$$

where h is the height of water, in metres, relative to the mean sea level
and t is the time in hours after midnight.



c2kiwi.blogspot.co.nz/2011/01/christchurch-wedding-stroll-on-beach.html

At what rate was the height of the tide changing at that beach at 9.00 a.m. today?

- $$x = 2\cos 2t \text{ and } y = \tan^2 t.$$

You must use calculus and show any derivatives that you need to find when solving this problem.

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What is the x -coordinate of point P?

- You must use calculus and show any derivatives that you need to find when solving this problem.*

QUESTION TWOASSESSOR'S
USE ONLY

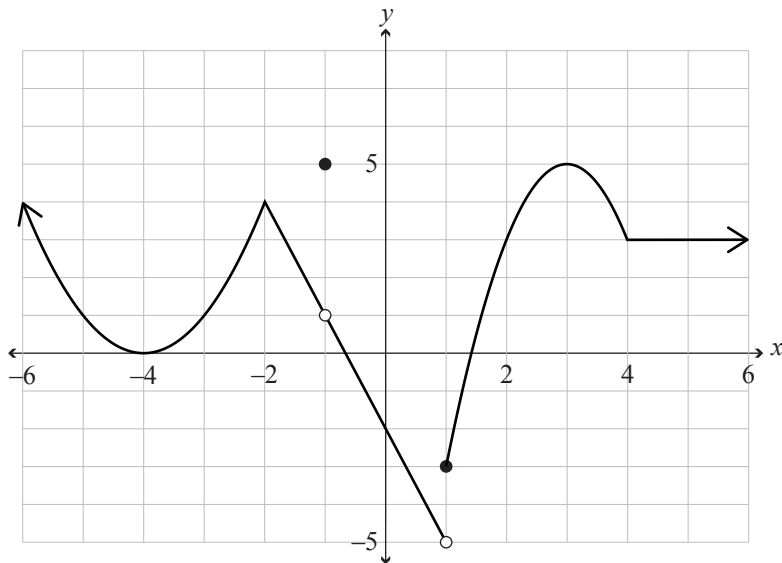
- (a) Differentiate $f(x) = x \ln(3x - 1)$.

- (b) Find the gradient of the tangent to the function $y = \sqrt{2x - 1}$ at the point $(5, 3)$.

You must use calculus and show any derivatives that you need to find when solving this problem.

(c) The graph below shows the function $y = f(x)$.

ASSESSOR'S
USE ONLY



For the function $y = f(x)$ above:

(i) Find the value(s) of x that meet the following conditions:

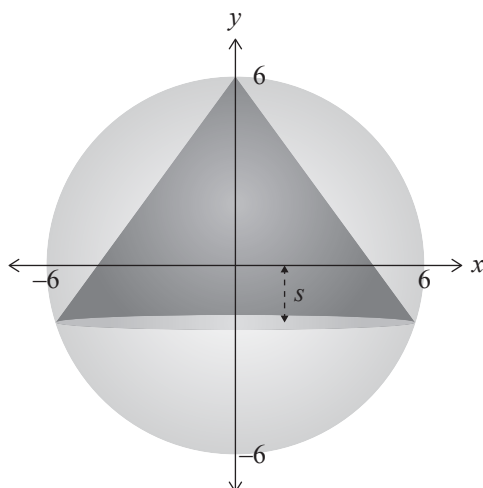
1. f is not continuous: _____
2. f is not differentiable: _____
3. $f'(x) = 0$: _____
4. $f''(x) < 0$: _____

(ii) What is the value of $\lim_{x \rightarrow -1} f(x)$?

State clearly if the value of the limit does not exist.

- You must use calculus and show any derivatives that you need to find when solving this problem.*

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QUESTION THREEASSESSOR'S
USE ONLY

- (a) Differentiate $f(x) = \sqrt[4]{3x+2}$.

- (b) Find the x -value at which a tangent to the curve $y = 6x - e^{3x}$ is parallel to the x -axis.

You must use calculus and show any derivatives that you need to find when solving this problem.

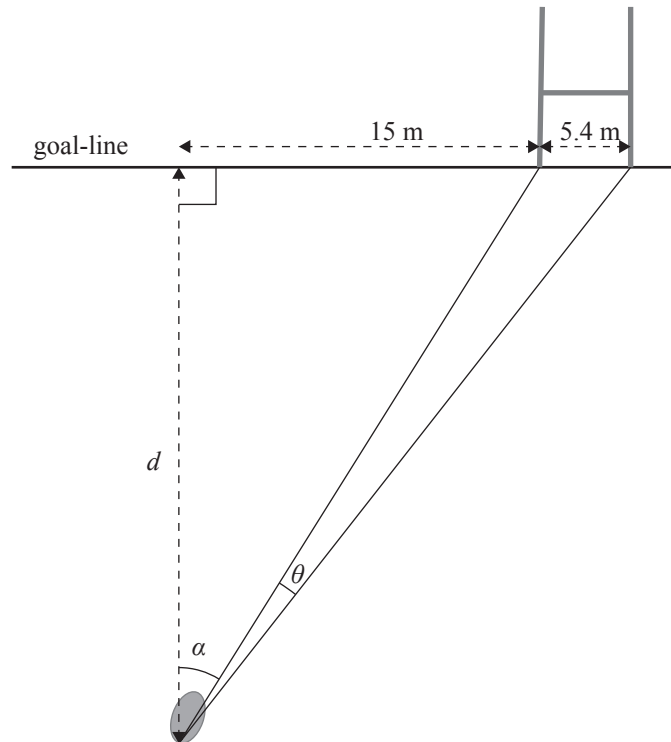
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- A Cartesian coordinate system showing a parabola opening upwards. The vertex of the parabola is at $(6, 0)$ on the x-axis. A rectangle is shaded with its base on the x-axis from $x=0$ to $x=3$. The height of the rectangle is equal to the y-value of the parabola at $x=3$.

You must use calculus and show any derivatives that you need to find when solving this problem.

(d) If $y = \frac{e^x}{\sin x}$, show that $\frac{dy}{dx} = y(1 - \cot x)$.

ASSESSOR'S
USE ONLY

- The ball needs to pass between the goal-posts, which are 5.4 m apart.



You must use calculus and show any derivatives that you need to find when solving this problem.

You do not need to prove that the angle you have found is a maximum.

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

QUESTION
NUMBER

ASSESSOR'S
USE ONLY

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

QUESTION
NUMBER

ASSESSOR'S
USE ONLY

