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NEW ZEALAND QUALIFICATIONS AUTHORITY
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QUALIFY FOR THE FUTURE WORLD
 KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Level 3 Calculus, 2018

91579 Apply integration methods in solving problems

9.30 a.m. Tuesday 13 November 2018
 Credits: Six

Achievement	Achievement with Merit	Achievement with Excellence
Apply integration methods in solving problems.	Apply integration methods, using relational thinking, in solving problems.	Apply integration 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 2–16 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) Find $\int \left(6x - \frac{8}{x^3} \right) dx$

(b) Solve the differential equation $\frac{dy}{dx} = e^{2x} + \frac{1}{x}$, given that when $x = 1$, $y = 2$.

(c) Find $\int_6^8 \frac{2x-7}{x-5} dx$

You must use calculus and show the results of any integration needed to solve the problem.

- (d) Solve the differential equation $\frac{dy}{dx} = \frac{\cos 2x}{e^y}$ given that $y = 0$ when $x = \frac{\pi}{4}$.

You must use calculus and show the results of any integration needed to solve the problem.

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- A graph illustrating the area under a curve $f(x)$ from $x=0$ to $x=k$. The curve is labeled $f(x)$ at the top left. The horizontal axis is labeled x at the right end. The vertical axis is labeled $f(x)$ at the top. The area under the curve is shaded gray. A vertical line segment at $x=k$ is labeled $Q(k,k)$.

The shaded region in the diagram is bounded by the curve, the x -axis and the line $x = k$.

You must use calculus and show the results of any integration needed to solve the problem.

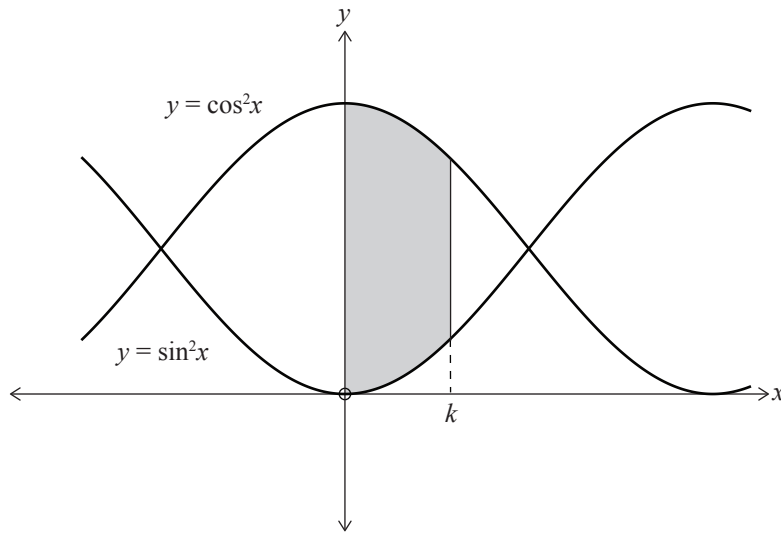
QUESTION TWOASSESSOR'S
USE ONLY

- (a) Find $\int (\sec^2 x + \sec 2x \tan 2x) dx$

- (b) Find the value of k , given that $\int_1^k \sqrt{x} dx = \frac{52}{3}$.

You must use calculus and show the results of any integration needed to solve the problem.

- (c) The diagram below shows the graphs of the functions $y = \cos^2 x$ and $y = \sin^2 x$.



Find the value of k such that $\int_0^k (\cos^2 x - \sin^2 x) dx = \frac{1}{2}$.

You must use calculus and show the results of any integration needed to solve the problem.

- You must use calculus and show the results of any integration needed to solve the problem.*

- $$\frac{dm}{dt} = -k(m - 10) \text{ where } k > 0 \text{ and } m \geq 10.$$

3 hours later the mass of the candle had halved.

You must use calculus and show the results of any integration needed to solve the problem.

QUESTION THREE

ASSESSOR'S
USE ONLY

(a) Find $\int \left((4x)^2 + 4x + \frac{4}{x} \right) dx$

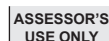
(b) Use the values given in the table below to find an approximation to $\int_0^3 f(x) dx$, using Simpson's Rule.

x	0	0.5	1	1.5	2	2.5	3
$f(x)$	0.3	0.75	1.1	1.35	1.6	1.15	0.5

(c) Find the value of k given that $\int_0^k 3e^{0.5x} dx = 75$.

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

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- A graph of the function $f(x) = (2x - 1)^4$ is shown on a Cartesian coordinate system. The curve is U-shaped and has a minimum at $x = 0.5$. A point $Q(1, 1)$ is marked on the curve, and a tangent line is drawn at this point. The area between the curve and the tangent line for $x > 1$ is shaded in light gray. The x-axis is labeled with x and the y-axis with y . The origin is marked with a small circle. The label $f(x) = (2x - 1)^4$ is placed near the y-axis. The label $Q(1, 1)$ is placed near the point of tangency. The label p is placed on the x-axis near the minimum of the curve.

Find the area of the region bounded by the curve, the x -axis, and the tangent to the curve at Q (shown shaded in the diagram).

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

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