1. Consider the function $f(x) = x^2$

a. By filling in the table of values, complete the limiting chord process for $f(x) = x^2$ at the point $x = 1$.

a	b	$h = b - a$	$\frac{f(b) - f(a)}{b - a}$
1	2	1	
1	1.5		
1	1.1		
1	1.05		
1	1.01		
1	1.001		
1	$1.000\,1$		

b. The instantaneous rate of change of $f(x)$ at $x = 1$ is:

2. The daily net profit of an upmarket restaurant can be modelled by the equation $y = -16x^2 + 304x$, where x is the number of customers.

   a. Find the value of y at $x = 0$.

   b. Find the value of y at $x = 9$.

   c. Hence find the average rate of change in net profit over the interval $[0,\ 9]$.

3. Differentiate the function
   $f(x) = (3x - 2)\left(4x^2 - 5\right)$.
   You may use the substitution $u = 3x - 2$ and $v = 4x^2 - 5$ in your working.

4. Differentiate
   $f(x) = \left(x^2 + 3x - 2\right)\left(x^2 - 3x - 2\right)$.
   You may use the substitution $u = x^2 + 3x - 2$ and $v = x^2 - 3x - 2$ in your working.

5. Suppose we want to differentiate $y = \dfrac{9x}{8x-5}$ using the Quotient Rule.

a. Identify the function u.

b. Identify the function v.

c. Find u'.

d. Find v'.

e. Hence find y'.

f. Is it possible for the derivative of this function to be zero?

A No

B Yes

6. Suppose we want to differentiate $y = \dfrac{3x}{2x^2-5}$ using the quotient rule. -----

a. Identify the function u.

b. Identify the function v.

c. Find u'.

d. Find v'.

e. Hence find y', giving your answer in factorised form.

7. Consider the function
$f(x) = \left(5x^3 + 8x^2 - 3x - 5\right)^6$.
Redefine the function as composite functions $f(u)$ and $u(x)$, where $u(x)$ is a polynomial.

$u(x) = \square$

$f(u) = (\square)^{\square}$

8. Find the primitive function of $9x^2 - 8x - 2$.
Use C as the constant of integration.

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9. Let $y = (x+3)^5$ be defined as a composition of the functions $y = u^5$ and $u = x + 3$.

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a. Determine $\frac{dy}{du}$.

b. Determine $\frac{du}{dx}$.

c. Hence determine $\frac{dy}{dx}$.

10. Find y if $\frac{dy}{dx} = \frac{1}{(4x+9)^6}$.
Use C as the constant of integration.

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11. The position (in metres) of an object along a straight line after t seconds is modelled by
$s(t) = 3t^2 + 7t + 4$.
We want to find the velocity of the object after 4 seconds.

a. Determine $v(t)$, the velocity function.

b. What is the velocity of the object after 4 seconds?

12. Find the equation of a curve given that the gradient at any point (x, y) is given by
$\frac{dy}{dx} = (x+2)^2$, and that the point $(-5, -7)$ lies on the curve.
Use C as the constant of integration.
