

Applying Calculus skills through techniques of Differentiation part 1

AH Mathematics HW

Essential knowledge:

1. Use the chain rule to differentiate:

(a) $e^{(\tan x)}$ (b) $\tan^{-1}(3x^2)$

2. Use the product rule to differentiate:

(a) $\sin^{-1} x \sec x$ (b) $x \ln x$

3. Use the quotient rule to differentiate:

(a) $\frac{x^2+2x+1}{3x-1}$ (b) $\frac{(1-2x)^3}{x^3}$

Unit level:

4. Find the derivative of:

(a) $f(x) = e^{(x^2 + \operatorname{cosec} x)}$

(b) $g(x) = \frac{\sec 4x}{x+2}$

(c) $y = 3x^3 \cot x$

(d) $y = \sec^2(2x)$

Assessment level:

5. Given that $f(x) = \sqrt{x} \exp(-x)$, $x \geq 0$ obtain and simplify $f'(x)$

6. Differentiate $g(x) = \frac{\tan^{-1}(2x)}{1+4x^2}$

7. Given that $f(x) = (x+1)(x-2)^3$, obtain the values of x for which $f'(x) = 0$

8. A particle is moving in a straight line, so that after t seconds, it's displacement x metres from a fixed point O is given by:

$$x = 9t + 3t^2 - t^3$$

(a) Find the initial displacement, velocity and acceleration of the particle.

(b) Find the time at which the particle is instantaneously at rest.

Challenge Questions (optional)

1. Which of the following is the equivalent to $(x + y + z)(x - y - z)$?

A $x^2 - y^2 - z^2$

B $x^2 - y^2 + z^2$

C $x^2 - xy - xz - z^2$

D $x^2 - (y + z)^2$

E $x^2 - (y - z)^2$

2. One of the following is equal to $\sqrt{9^{16x^2}}$ for all values of x . Which one?

A 3^{4x}

B 3^{4x^2}

C 3^{8x^2}

D 9^{4x}

E 9^{8x^2}

3. A Mersenne prime is a prime of the form: $2^p - 1$, where p is also prime. One of the following is **not** a Mersenne prime. Which one is it?

A $2^2 - 1$

B $2^3 - 1$

C $2^5 - 1$

D $2^7 - 1$

E $2^{11} - 1$

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ACADEMY