DIFFERENTIATION & FUNCTIONS (Q 6, 7 & 8, PAPER 1) **LESSON NO. 3: DIFFERENTIATION 1: SUMS OF TERMS** 2007 6 (a) Let $g(x) = x^2 - 6x, x \in \mathbf{R}$. (i) Write down g'(x), the derivative of g(x). (ii) For what value of x is g'(x) = 0? (a) Differentiate $6x^4 - 3x^2 + 7x$ with respect to x. 7 **SOLUTION** 6 (a) (i) **REMEMBER IT AS:** $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ 1 Multiply down by the power and subtract one from the power. **MULTIPLY BY A CONSTANT RULE:** If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$ $g(x) = x^2 - 6x \Longrightarrow g'(x) = 2x - 6$ 6 (a) (ii) $g'(x) = 0 \Longrightarrow 2x - 6 = 0$ $\Rightarrow 2x = 6 \Rightarrow x = 3$ **REMEMBER IT AS:** 7 (a) $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ 1 Multiply down by the power and subtract one from the power. **MULTIPLY BY A CONSTANT RULE:** If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$ $y = 6x^4 - 3x^2 + 7x \Longrightarrow \frac{dy}{dx} = 24x^3 - 6x + 7$

2006

7 (a) Differentiate $5x^3 - 4x + 7$ with respect to x. SOLUTION $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ (1)Multiply down by the power and subtract one from the power. CONSTANT RULE: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$ MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$. $y = 5x^3 - 4x + 7$ $\Rightarrow \frac{dy}{dx} = 5 \times 3x^2 - 4 \times 1 + 0$ $\Rightarrow \frac{dy}{dx} = 15x^2 - 4$

2005

7 (a) Differentiate $9+3x-5x^2$ with respect to x.

SOLUTION

REMEMBER IT AS: $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ 1 Multiply down by the power and subtract one from the power.

CONSTANT RULE: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$

MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$. $y = 9 + 3x - 5x^2$

$$\Rightarrow \frac{dy}{dx} = 0 + 3 \times 1 - 5 \times 2x$$
$$\Rightarrow \frac{dy}{dx} = 3 - 10x$$

2004

7 (a) Differentiate with respect to *x*: (i) $2x^5$

(ii)
$$4(3-x^2)$$
.

SOLUTION

7 (a) (i)

 $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ 1

Multiply down by the power and subtract one from the power.

REMEMBER IT AS:

CONSTANT RULE: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$

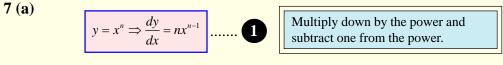
MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$. $y = 2x^5 \Longrightarrow \frac{dy}{dx} = 2 \times 5x^4 = 10x^4$ 7 (a) (ii)

$$y = 4(3 - x^{2}) = 12 - 4x^{2}$$
$$\Rightarrow \frac{dy}{dx} = 0 - 4 \times 2x = -8x$$

2003 7 (a) Differentiate with respect to *x*: (i) x^3 (ii) $\frac{x^2 - x^4}{2}$. **SOLUTION** REMEMBER IT AS: 7 (a) (i) $y = x^n \Rightarrow \frac{dy}{dx} = nx^{n-1}$ Multiply down by the power and subtract one from the power. **CONSTANT RULE:** If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$ MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$ $y = x^3 \Longrightarrow \frac{dy}{dx} = 3x^2$ 7 (a) (ii) $y = \frac{x^2 - x^4}{2} = \frac{1}{2}x^2 - \frac{1}{2}x^4$ $\Rightarrow \frac{dy}{dx} = \frac{1}{2} \times 2x - \frac{1}{2} \times 4x^3 = x - 2x^3$ 2002 7 (a) Differentiate $7x^3 - 3x^2 + 9x$ with respect to x.

(b) (i) Differentiate
$$x^5 - 17 + \frac{1}{x^5}$$
 with respect to x.

SOLUTION



REMEMBER IT AS:

CONSTANT RULE: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$

MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$. $y = 7x^3 - 3x^2 + 9x$ $\Rightarrow \frac{dy}{dx} = 7 \times 3x^2 - 3 \times 2x + 9 = 21x^2 - 6x + 9$ 7 (b) (i) $y = x^5 - 17 + \frac{1}{x^5} = x^5 - 17 + x^{-5}$ Power Rules $\Rightarrow \frac{dy}{dx} = 5x^4 - 0 - 5x^{-6}$ 4. $a^{-n} = \frac{1}{a^n}$ Ex. $x^{-3} = \frac{1}{x^3}$ $\Rightarrow \frac{dy}{dx} = 5x^4 - \frac{5}{x^6}$

2001

7 (a) Differentiate with respect to x

(i) $6x^5 + x^2$

(ii) (x-3)(x+3)

8 (a) Let $g(x) = x^4 - 32x$ for $x \in \mathbf{R}$.

(i) Write down g'(x), the derivative of g(x).

(ii) For what value of x is g'(x) = 0?

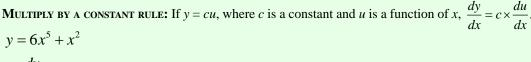
SOLUTION

 $y = x^{n} \Rightarrow \frac{dy}{dx} = nx^{n-1}$ 1

REMEMBER IT AS:

Multiply down by the power and subtract one from the power.

Constant Rule: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$



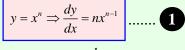
$$\Rightarrow \frac{dy}{dx} = 6 \times 5x^4 + 2x = 30x^4 + 2x$$

7 (a) (ii)

You could use the product rule but it is easier to multiply out the brackets and differentiate term by term.

$$y = (x-3)(x+3) = x^{2} + 3x - 3x - 9 = x^{2} - 9$$
$$\Rightarrow \frac{dy}{dx} = 2x - 0 = 2x$$

8 (a) (i)

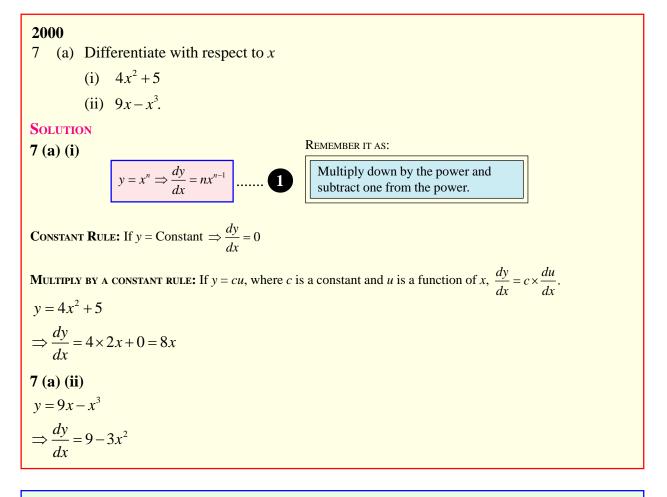


REMEMBER IT AS:

Multiply down by the power and subtract one from the power.

CONSTANT RULE: If $y = \text{Constant} \Rightarrow \frac{dy}{dx} = 0$

MULTIPLY BY A CONSTANT RULE: If y = cu, where c is a constant and u is a function of x, $\frac{dy}{dx} = c \times \frac{du}{dx}$. $g(x) = x^4 - 32x$ $\Rightarrow g'(x) = 4x^3 - 32$ **8 (a) (ii)** $g'(x) = 0 \Rightarrow 4x^3 - 32 = 0$ $\Rightarrow 4x^3 = 32$ $\Rightarrow x^3 = 8$ $\therefore x = 2$



1999

