

MCS21 – Calculus
Exam 3 Review Sheet

Topics:

- the definition of continuity
- the definition of the derivative
- the alternate definition of the derivative
- the power rule
- the product rule
- the quotient rule

Practice:

1. Find the derivative of each function.

(a) $y = 3x + 4x^2$

(b) $f(x) = 5\pi^2x - 8x^4$

(c) $h(x) = -2x^5 + 5\sqrt{x} - \sqrt[3]{x}$

2. Use the definition of the derivative to find $f'(x)$ if

(a) $f(x) = \sqrt{x+2}$

(b) $f(x) = x^2 - 5x + 1$

3. Use the alternate definition of the derivative to find $f'(1)$ if $f(x) = \frac{7}{x-4}$.

4. Given $f(x) = \begin{cases} x^2 - 1 & x \neq 1 \\ 4 & x = 1 \end{cases}$. Which of the following are true? Explain.

(i) $\lim_{x \rightarrow 1} f(x)$ exists

(ii) $f(1)$ exists

(iii) f is continuous at $x = 1$

5. Find $\frac{dx}{d\theta}$ if $x = 2\theta^{-2} - \theta$

6. Find $\frac{dx}{dt}$ if $x = \frac{t-5}{t+5}$

7. Find $\frac{dy}{dx}$ if $y = \frac{x^5 - 3x^4}{x^2 + 7x}$

8. Find $\frac{dy}{dx}$ if $y = (9x^2 + 4x)(x^3 - 5x^2)$

9. Find $\frac{dy}{dx}$ if $y = (\sqrt{x} + 4\sqrt[3]{x})(x^5 - 11x^8)$

10. Find $\left. \frac{dy}{dx} \right|_{x=1}$ if $y = \frac{(x+3)(x^3-9)}{(x^2+4)(x-8)}$

11. Given $u(4) = -2$, $u'(4) = 4$, $v(4) = 6$, and $v'(4) = -6$.

(a) Find $h'(4)$ if $h(x) = \frac{u(x)}{v(x)}$

(b) Find $h'(4)$ if $h(x) = \frac{u(x)}{\sqrt{x}}$

12. If $f(7) = 11$, $f'(7) = -3$, $g(7) = 1$, and $g'(7) = -4$, find $h'(7)$ if $h(x) = f(x) \cdot g(x)$