Class 12 Mathematics · Chapter 5: Continuity and Differentiability

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. Let f(x) = 2x + 1 for x < 3, f(3) = 4, and f(x) = x + 4 for x > 3. At x = 3, f is [1]

(a) continuous, since the left and right hand limits are equal
(b) discontinuous, since the left and right hand limits are unequal
(c) not defined, so the question of continuity does not arise
(d) discontinuous, since the limit at 3 exists but is not equal to f(3)

2. $\frac{d}{dx}\cos(x^3)$ is [1]

(a) $-3x^2\sin(x^3)$
(b) $-\sin(x^3)$
(c) $3x^2\sin(x^3)$
(d) $-3x^2\cos(x^3)$

3. The derivative of 5^x at x = 0 is [1]

(a) 0
(b) 5 log 5
(c) 1
(d) log 5

4. The function $f(x) = \frac{x^3 - 8}{x - 2}$ for $x \neq 2$, and f(2) = k, is continuous at x = 2. The value of k is [1]

(a) 4
(b) 6
(c) 12
(d) 0

5. Which statement about $f(x) = \frac{1}{x}$, $x \neq 0$, is correct? [1]

(a) f is a continuous function, since it is continuous at every point of its domain
(b) f is discontinuous at x = 0, so it is not a continuous function
(c) f is continuous only for x > 0
(d) $\lim_{x\to 0^+} f(x)$ exists and equals $+\infty$, a real number

6. If $x = e^t + e^{-t}$ and $y = e^t - e^{-t}$, show that $\frac{dy}{dx} = \frac{x}{y}$. [2]

7. If $y = \log(x^2 + 1)$, find $\frac{d^2y}{dx^2}$. [2]

8. Find k if f(x) = kx + 3 for $x \leq 2$ and $f(x) = x^2 - k$ for x > 2 is continuous at x = 2. [2]

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9. Show that $f(x) = x^2$ for $x \le 1$ and $f(x) = 2x - 1$ for $x > 1$ is differentiable at $x = 1$. [3]

10. Find a and b so that $f(x) = ax + 5$ for $x \le 1$, $f(x) = x^2 + b$ for $1 < x < 3$, and $f(x) = 2bx - 1$ for $x \ge 3$ is a continuous function. [3]

11. For $x < 1$, let $y = \tan^{-1}\left(\frac{1+x}{1-x}\right)$. Find $\frac{dy}{dx}$ (i) by writing $x = \tan\theta$, and (ii) directly by the chain rule, and show that the two results agree. [3]