Key

November/December '25

Chapter 3 Practice Test

In any problem that is multiple choice, select the best answer. In any free response problem, analysis is required. Remember to round any decimal approximations to 3 decimal places.

1. Find $\frac{dy}{dx}$ if $y = \frac{2x+5}{3x-1}$ Quotient Rule

(a) $\frac{17}{(3x-1)^2}$ (b) $-\frac{17}{(3x-1)^2}$ (c) $\frac{17}{(2x-5)^2}$ (d) $\frac{12x+13}{(3x-1)^2}$ (e) $\frac{2}{3}$

$$\frac{(3x-1)2-(2x+5)3}{(3x-1)^2}$$

$$\frac{6x-2-6x-15}{(3x-1)^2} \qquad \frac{-17}{(3x-1)^2}$$

2. Find $\frac{dy}{dx}$ if $3\cos x + \sin y = x^2$ Implicit diff.

(a) $\frac{2x+3\sin x}{\sin y}$ (b) $\frac{2x+3\sin x}{\cos y}$ (c) $\frac{x^2-3\cos x}{\sin y}$ (d) $\frac{3\sin x}{\cos y}$ (e) $\frac{2x-3\sin y}{\cos y}$

$$-3\sin x + \cos y \frac{dy}{dx} = 2x$$

$$\cos y \frac{dy}{dx} = 2x + 3\sin x$$

$$\frac{dy}{dx} = \frac{2x+3\sin x}{\cos y}$$

Product

3. Find $\frac{dy}{dx}$ if $y = x^3 e^{2x}$

(a) $6x^2 e^{2x}$ (b) $x^3 e^{2x} + 3x^2 e^{2x}$ (c) $2x^3 e^{2x} + 3x^2 e^{2x}$ (d) $x^3 e^2 + 3x^2 + 3x^2 e^{2x}$ (e) $x^3 e^{2x} + 6x^2 e^{2x}$

$x^3 \cdot 2e^{2x} + 3x^2 e^{2x}$

$2x^3 e^{2x} + 3x^2 e^{2x}$

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

(a) $\frac{2x+5}{\ln x^2 + 5x}$ (b) $\frac{5x+2}{x}$ (c) $\frac{1}{2x+5}$ (d) $\frac{2x+5}{x^2+5x}$ (e) $2x + 5\ln x^2 + 5x$

$\frac{d}{dx} \ln x^2 \rightarrow \frac{1}{x^2} \cdot 2x \rightarrow \frac{2}{x}$

$\frac{d}{dx} 5x = 5$

$\frac{2}{x} + 5\left(\frac{x}{x}\right)$

$\frac{5x+2}{x}$

5. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = 2t^3 - 5t - 3$, where s is measured in feet and t is measured in seconds.

(a) Find the displacement during the first 5 seconds.
(b) Find the average velocity during the first 5 seconds.
(c) Find the instantaneous velocity when t = 5.
(d) Find the acceleration of the particle when t = 5.
(e) At what value or values of t does the particle change direction?

(a) $s(5) - s(0)$ $\quad s(5) = 2(5)^3 - 5(5) - 3$

$222 - (-3) = \boxed{225}$ $\quad 250 - 25 - 3$

$225 - 3$

222

(b) $\frac{225}{5-1} = \frac{225}{4} \rightarrow \boxed{56.25}$ like $s(0) = -3$

(c) $s'(t) = 6t^2 - 5$

$s'(5) = 6(5)^2 - 5 \rightarrow 6(25) - 5$ $\quad 150 - 5$

$\boxed{145 \frac{ft}{sec}}$

(d) $s''(t) = 12t$

(e) $6t^2 - 5 = 0$

$t^2 = \frac{5}{6}$

$t = \sqrt{\frac{5}{6}}$ sec

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

$\boxed{3^{2x+5} \ln 3 (2)}$

7. Find an equation of the line that is normal to the graph of $4x + 2x^2y - y^2 = 23$ at (2, 3)

$4 + 2(x^2\frac{dy}{dx} + 4xy) - 2y\frac{dy}{dx} = 0$

$4 + 2x^2\frac{dy}{dx} + 8xy - 2y\frac{dy}{dx} = 0$

$\frac{dy}{dx}[2x^2 - 2y] = -4 - 8xy$

$\frac{dy}{dx} = \frac{-4 - 8xy}{2x^2 - 2y}$ $\quad \frac{-2 - 4xy}{x^2 - y}$ $\quad (2, 3)$ $\quad \frac{-2 - 4(2)(3)}{4 - 3}$

Slope $-\frac{26}{1}$ $\quad y - 3 = -26(x - 2)$

8. Let $f(x) = \sqrt[3]{x-2}$

(a) Find NDER(f(x), 3) and NDER(f(x), 2) = 100

(b) Explain which is a meaningful estimate of a derivative of *f(x)* and why the other is not a good estimate of derivative of *f(x)*

No because $(x-2)$ Vertical Tangent

The derivative doesn't exist.

9.

If $y = x^2 \sec(2x)$, then $\frac{dy}{dx} =$

(A) $2x^2 \tan(2x)$

(B) $4x \sec(2x)\tan(2x)$

(C) $x^2 \sec(2x) + 2x\sec(2x)$

(D) $2x^2 \sec(2x) + 2x\tan(2x)$

(E) $2x^2 \sec(2x)\tan(2x) + 2x\sec(2x)$

$x^2 \sec(2x)\tan(2x)\cdot 2 + 2x\sec(2x)$

$2x^2 \sec(2x)\tan 2x + 2x\sec 2x$

~logarithmic diff.

10. The slope of the tangent line to the curve $y = (x)^{\sin x}$ at x = π is:

a) -ln π b) $-\pi$ c) -1 d) 0 e) e

$\ln y = \sin x \ln x$

$\frac{1}{y}\frac{dy}{dx} = \frac{\sin x}{x} + \cos x \ln x$

$\frac{dy}{dx} = y\left(\frac{\sin x}{x} + \cos x \ln x\right)$

$x^{\sin x}\left(\frac{\sin x}{x} + \cos x \ln x\right)$

$\pi^{\sin\pi}\left(\frac{\sin\pi}{\pi} + \cos\pi \ln\pi\right)$

$1(0 + (-1)\ln\pi)$

11. If $h(x) = [f(3x)][g(2x)]$ and it is known that f(9) = -4, f ' (9) = 5, g(6)=1 and g ' (6) = 2, then h ' (3) =

a) -1 b) 1 c) 3 d) -3 e) 31

$x=3$ $f(3x)\cdot 2g'(2x) + g(2x)\cdot 3f'(3x)$

$f(9)\cdot 2g'(6) + g(6)\cdot 3f'(9)$

$-4\cdot 2(2) + 1\cdot 3\cdot 5$

$-16 + 15 = -1$

12.

$$f(x)=\begin{cases} x-4 & \text{if } x\le 3 \\ x^2-10 & \text{if } x>3 \end{cases}$$

$f(3) = -1$

$9-10=-1$ ✓

Let f be the function given above. Which of the following statements are true about f?

I. $\lim_{x\to 3} f(x)$ exists ✓

II. f is continuous at $x=3$ ✓

III. f is differentiable at $x=3$ NOT

$f'(x) = \frac{1}{6}$ NOT the same derivative

(A) I only (B) II only (C) I and II only (D) I and III only (E) I, II, and III

$f'(x) = \begin{cases} 1 \\ 2x \end{cases}$

$f'(3) = \frac{1}{6}$

13. A particle's movement along a vertical line is described by the function $y = -4t+5$. Find the particle's speed at $t = 10$.

$y' = -4$ Speed $= 4$