SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) Suppose that the dollar cost of producing x radios is \( c(x) = 400 + 20x - 0.2x^2 \). Find the marginal cost when 40 radios are produced.

2) Assume that a watermelon dropped from a tall building falls \( y = 16t^2 \) ft in t sec. Find the watermelon's average speed during the first 4 sec of fall and the speed at the instant \( t = 4 \) sec.

3) Does the graph of the function \( y = \tan x - x \) have any horizontal tangents in the interval \( 0 \leq x \leq 2\pi \)? If so, where?

Write the function in the form \( y = f(u) \) and \( u = g(x) \). Then find \( \frac{dy}{dx} \) as a function of \( x \).

4) \( y = \cos^6 x \)
5) \( y = \tan \left( \pi - \frac{9}{x} \right) \)

6) \( y = (-3x + 7)^5 \)

Find \( \frac{d^2y}{dx^2} \) for the given function.

7) \( y = 3 \cot \left( \frac{x}{10} \right) \)

8) \( y = -2x^4(3x + 8)^2 \)

Find the value(s) of \( x \) for which the slope of the curve \( y = f(x) \) is 0.

9) \( f(x) = \frac{x - x^2}{2x^2 + 6} \)
Find the indicated derivative.

10) Find $y''$ if $y = 6x \sin x$.  

Find the value(s) of $x$ for which the slope of the curve $y = f(x)$ is 0.

11) $f(x) = \frac{8x^2}{x^2 + 1}$  

Find the derivative.

12) $s = 2t^2 + 7t + 4$  

Find the derivative of the function.

13) $q = \sqrt{20t - r^2}$
Find the derivative.

14) \( p = \frac{\sec q + \csc q}{\csc q} \)

Find the derivative of the function.

15) \( g(x) = \frac{x^2 + 5}{x^2 + 6x} \)

Find the derivative.

16) \( y = 6 - 3x^2 \)

17) \( y = \frac{2}{\sin x} + \frac{1}{\cot x} \)
Find the derivative of the function.

18) \( f(t) = (6 - t)(6 + t^3)^{-1} \)

19) \( r = (\sec \theta + \tan \theta)^{-3} \)

Provide an appropriate response.

20) Find all points \((x, y)\) on the graph of \( y = \frac{x}{x - 7} \) with tangent lines perpendicular to the line \( y = 7x - 2 \).
21) Find an equation for the tangent to the curve \( y = \frac{27}{x^2 + 2} \) at the point \( (1, 9) \).

22) The curve \( y = ax^2 + bx + c \) passes through the point \((2, 8)\) and is tangent to the line \( y = 2x \) at the origin. Find \( a, b, \) and \( c \).

23) The function \( s = f(t) \) gives the position of a body moving on a coordinate line, with \( s \) in meters and \( t \) in seconds.

\[ s = 5t^2 + 3t + 7, \quad 0 \leq t \leq 2 \]

Find the body's speed and acceleration at the end of the time interval.
Find the second derivative of the function.

24) \( y = \frac{x^4 + 7}{x^2} \)

Given \( y = f(u) \) and \( u = g(x) \), find \( \frac{dy}{dx} = f'(g(x))g'(x) \).

25) \( y = \frac{1}{u^2} \), \( u = 6x - 5 \)

26) \( y = \sin u \), \( u = \cos x \)

Find \( y' \).

27) \( y = (x^2 - 2x + 2)(4x^3 - x^2 + 5) \)
Find $\frac{dy}{dt}$.

28) $y = \cos(\sqrt{8t + 11})$

Find $y'$.

29) $y = \left( \frac{2}{x} + x \right) \left( \frac{2}{x} - x \right)$

Find $\frac{dy}{dt}$.

30) $y = 5(t + 3)^4$
Find the second derivative.
31) \( y = 8x^4 - 7x^2 + 7 \)

The equation gives the position \( s = f(t) \) of a body moving on a coordinate line (s in meters, t in seconds).
32) 

When is the body moving forward?

Find an equation of the tangent line at \( x = a \).
33) \( y = x - x^2; \ a = 4 \)
Answer Key
Testname: M150_2.1-2.4PRACTICE

1) $4$
2) 64 ft/sec; 128 ft/sec
3) Yes, at $x = 0$, $x = \pi$, $x = 2\pi$
4) $y = u^6; u = \cos x; \frac{dy}{dx} = -6 \cos^5 x \sin x$
5) $y = \tan u; u = \pi - \frac{9}{x}; \frac{dy}{dx} = \frac{9}{x^2} \sec^2 \left( \pi - \frac{9}{x} \right)$
6) $y = u^5; u = -3x + 7; \frac{dy}{dx} = -15(-3x + 7)^4$
7) $\frac{3}{50} \csc^2 \left( \frac{x}{10} \right) \cot \left( \frac{x}{10} \right)$
8) $-540x^4 - 1920x^3 - 1536x^2$
9) $x = -3 \pm 2\sqrt{3}$
10) $y'' = 12 \cos x - 6x \sin x$
11) $x = 0$
12) $4t + 7$
13) $\frac{20 - 7r^6}{2\sqrt{20r} - r^7}$
14) $\frac{dp}{dq} = \sec^2 q$
15) $g'(x) = \frac{6x^2 - 10x - 30}{x^2(x + 6)^2}$
16) $-6x$
17) $y' = -2 \csc x \cot x + \sec^2 x$
18) $f'(t) = \frac{2t^3 - 18t^2 - 6}{(6 + t^3)^2}$
19) $\frac{-3 \sec \theta}{(\sec \theta + \tan \theta)^3}$
20) $(0, 0), (14, 2)$
21) $y = -6x + 15$
22) $a = 1, b = 2, c = 0$
23) 23 m/sec, 10 m/sec
24) $\frac{d^2y}{dx^2} = 2 + \frac{42}{x^4}$
25) $\frac{-12}{(6x - 5)^3}$
26) $-\cos(\cos x) \sin x$
27) $20x^4 - 36x^3 + 30x^2 + 6x - 10$
28) $\frac{4}{\sqrt{8t + 11}} \sin(\sqrt{8t + 11})$
29) $\frac{-8}{x^3} - 2x$
30) $5(3t + 3)^3(15t + 3)$
31) $96x^2 - 14$
32) $0 < t < 1, 3 < t < 4, 5 < t < 7, 9 < t < 10$
33) $y = -7x + 16$