Homework 10/9

Identify each problem as type

I: “Given location, find slope,”

II: “Given slope, find location,” or

III: “Find unknown constants.”

Then solve each problem.

1. An object is dropped from a tower so that after \( t \) seconds its height above ground is \( h(t) = 100 - 16t^2 \) feet.

   (a) What is its velocity after 2 seconds?

   (b) When is its velocity \(-60\) ft/s?

   (c) What is its velocity at the time when it hits the ground?

   (d) How high is it when its velocity is \(-48\) ft/s?

2. The graph of \( f(x) = \frac{1}{x} \) has a tangent line that passes through \((0, 1.5)\) as shown at right. Where is the point of tangency?

3. Find the slope of the tangent to \( y = \sin(2x) \) at the point \( x = 1 \).

4. Find one point on the graph of \( y = \sin(2x) \) where the slope of the tangent line is 1.

5. Section 3.4; problems 32, 34, 35, 36. (No sketches or graphs required.)

6. The parabola \( y = x^2 + ax + b \) has a horizontal tangent at \((2, -1)\). Find \( a \) and \( b \).

7. Section 3.2; problem 53.
8. The graph of $y = ax^3 + bx^2 + cx + k$ has horizontal tangents at $(0, 1)$ and at $(-3, 2)$. Find $a$, $b$, $c$ and $k$.

9. A particle moves in a straight path so that its position (in meters) is given by $s(t) = 1.3 \sin(\omega t)$, with $t$ in seconds. If its velocity at time $t = 0$ is $0.2$ m/s, what is the value of the constant $\omega$? What are the units on $\omega$?

10. Section 3.3; problem 11.

Selected Answers:
1: (a) $-64$ ft/s; (b) $1.875$ s; (c) $-80$ ft/s; (d) $64$ ft
2: $(4/3, 3/4)$
3: $2 \cos 2$, or approximately $-0.8323$
4: $(\pi/6, \sqrt{3}/2)$ is one possible answer. There are many more.
5: (32) no solutions; (34) $\pi/6$ and $5\pi/6$; (36) $\pi/2$, $5\pi/2$, $11\pi/2$, etc.
6: $a = -4$ and $b = 3$. 

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