

**AP CALCULUS AB**  
**Supplement 2.3**  
**Differentiation**

Name \_\_\_\_\_  
Date \_\_\_\_\_  
Period \_\_\_\_\_

1. Write an equation for the line tangent to  $g(x) = \frac{4}{x} - 6\sqrt[3]{x}$  at  $x = 8$ .
2. Find the values of  $a$  and  $b$  such that the tangent to the curve  $r(x) = 18x - 3ax^3$  at  $x = 2$  is equivalent to  $3x + by = 12$ .
3. Calculate  $\left. \frac{d^3y}{dx^3} \right|_{x=4}$  given that  $y = \frac{32}{\sqrt{x}}$ .
4. Write an equation for the normal line for  $P = \frac{8x^2}{x-1}$  at  $x = -1$ .
5. Calculate  $h'(2)$  given that  $h(x) = e^x f(x)$ ,  $f(2) = -3$ , and  $f'(2) = 5$ .
6. Find the first and second derivatives for  $g(x) = \csc x$  and  $h(\alpha) = \sec \alpha$ .
7. For what value(s) of  $x$  does the graph of  $f(x) = x + 2\sin x$  have a horizontal tangent on the interval  $0 \leq x \leq 2\pi$ ?

### AB Supplement 2.3 Solutions

1.  $y + \frac{23}{2} = -\frac{9}{16}(x-8)$  OR  $y = -\frac{9}{16}x - 7$

2.  $a = \frac{3}{4}, b = \frac{1}{3}$

3.  $\frac{d^3y}{dx^3} = -\frac{60}{x^{7/2}} \rightarrow \left. \frac{d^3y}{dx^3} \right|_{x=4} = -\frac{15}{32}$

4.  $y + 4 = -\frac{1}{6}(x+1)$  OR  $y = -\frac{1}{6}x - \frac{25}{6}$

5.  $h'(2) = 2e^2$

6.  $g'(x) = -\csc(x)\cot(x)$   
 $g''(x) = \csc x(\csc^2 x + \cot^2 x)$

$$h'(\alpha) = \sec(\alpha)\tan(\alpha)$$

$$h''(\alpha) = \sec \alpha(\sec^2 \alpha + \tan^2 \alpha)$$

7.  $x = \frac{2\pi}{3}, \frac{4\pi}{3}$