

Unit 5 Test Review
Honors ICM



Name KEY

Find the derivative of the function using the limit definition of derivative. Show all work!

1. $f(x) = 2x + 4$
 $f'(x) = 2$

2. $f(x) = \frac{2}{x+3}$
 $f'(x) = \frac{-2}{(x+3)^2}$

3. $f(x) = \sqrt{x+6}$
 $f'(x) = \frac{1}{2\sqrt{x+6}}$

4. $f(x) = 3x^2 - x + 2$
 $f'(x) = 6x - 1$

Find the equation for the tangent line at the given point.

5. $f(x) = x^2 + 3x - 1$; (1,3)
 $y - 3 = 5(x - 1)$
 $y = 5x - 2$

point-slope Form
 $y - y_1 = m(x - x_1)$
6. $f(x) = \frac{1+x^2}{x+5}$; $(0, \frac{1}{5})$
 $y - \frac{1}{5} = -\frac{1}{25}(x - 0)$
 $y = -\frac{1}{25}x + \frac{1}{5}$

7. $f(x) = -4x + 3$; $x = -1$
 $y - 7 = -4(x + 1)$
 $y = -4x + 3$

8. $f(x) = -5x^2 + 8x + 2$; $x = 3$
 $y + 19 = -22(x - 3)$
 $y = -22x + 47$

9. $f(x) = (x^2 + 2)(2x^2 - 4)$; (1,2)
 $y - 2 = 6(x - 1)$
 $y = 6x - 4$

10. $f(x) = \frac{1}{x^2}$; (-1,1)
 $y - 1 = 2(x + 1)$
 $y = 2x + 3$

Find the slope of the tangent line to the graph of f at a given point.

11. $f(x) = (4x^3 - 5x^2)(1 + 2x)$; (-1,7)
 $m = -40$

12. $f(x) = \frac{2x - 3x^2}{5x + 1}$; $x = 2$
 $m = \frac{-70}{121}$

13. $f(x) = \frac{6}{x+1}$; $x = 2$
 $m = \frac{-2}{3}$

14. $f(x) = 3x^3 - 6x^2 + 5x - 4$; (-2,8)
 $m = -67$

15. The displacement s (in meters) of a particle moving in a straight line is given by the equation of motion

$s = 4t^3 + 6t + 2$, where t is measure in seconds. Find the instantaneous velocity of the particle s at times

$t = a$, $t = 1$, and $t = 3$.
 $s' = 12t^2 + 6$
 $s'(a) = 12(a)^2 + 6$

$s'(1) = 12(1)^2 + 6 = 18 \text{ m/s}$
 $s'(3) = 12(3)^2 + 6 = 114 \text{ m/s}$

16. If an arrow is shot upward on the moon with a velocity of 58 miles/s, its height (in meters) after t seconds is given by $H = 58t - 1.63t^2$. The moon is at the maximum.

$H' = 58 - 1.66t$

a) Find the Instantaneous velocity of the arrow after 1 second.

$H'(1) = 58 - 1.66(1) = 56.34 \text{ m/s}$

b) At what time t will the arrow hit the moon? $\rightarrow \text{max}$

$a + 34.9397 \text{ sec}$

c) with what velocity will the arrow hit the moon?

$v = s' = 58 - 1.66t$

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$$v = 3t^2 - 12t + 9$$

17. The position of a particle at time t sec is $s = t^3 - 6t^2 + 9t$ meters.

(a) Find the instantaneous velocity $t = 4$ seconds.

$$9 \text{ m/sec}$$

(b) Find the acceleration for each time the particle's velocity is zero.

$$a = 6t - 12$$

$$\textcircled{1} 0 = 3t^2 - 12t + 9$$

Find $t \rightarrow$

$$-6 \text{ m/sec}^2, 6 \text{ m/sec}^2$$

18. A projectile is shot upward from the surface of earth with an initial velocity of 120 meters per second. The position equation is $s(t) = -4.9t^2 + 120t$

a. What is the projectile's velocity after 5 seconds?

$$71 \text{ m/sec}$$

b. What is the projectile's acceleration after 5 seconds?

$$-9.8 \text{ m/sec}^2$$

Find the derivative.

19. $f(x) = 9x^{-2} + \sqrt{2x^5 - x^3}$

$$f'(x) = \frac{-18}{x^3} + \frac{10x^4 - 3x^2}{2\sqrt{2x^5 - x^3}}$$

20. $f(x) = \frac{2}{5x^2}$

$$f'(x) = \frac{-4}{5x^3}$$

21. $g(x) = 3x^2 - \sqrt[4]{x^3}$

$$g'(x) = 6x - \frac{3}{4\sqrt[4]{x}}$$

22. $h(x) = (x^3 - 7)(2x^3 + 3)$

$$h'(x) = 12x^5 - 33x^2$$

23. $f(x) = (2x^2 - 4x + 1)(6x - 5)$

$$f'(x) = 36x^2 - 68x + 26$$

24. $f(x) = x^{5/2}(3x^2 - 2x + 6)$

$$f'(x) = \frac{21}{2}x^{5/2} - 5x^{3/2} + 9x^{1/2}$$

25. $g(x) = 12x^{3/5} + \sqrt[3]{2x^4 - 4x}$

$$g'(x) = \frac{36}{5\sqrt[5]{x^2}} + \frac{8x^3 - 4}{3\sqrt[3]{(2x^4 - 4x)^2}}$$

26. $f(x) = (x^5 - 2x^3)(7x^2 + x - 8)$

$$f'(x) = 49x^6 + 6x^5 - 110x^4 - 8x^3 + 48x^2$$

27. $h(x) = \frac{5x - 6}{3x + 7}$

$$h'(x) = \frac{53}{(3x + 7)^2}$$

28. $f(x) = \frac{6 - x + 3x^2}{4 - 9x}$

$$f'(x) = \frac{-27x^2 + 24x + 50}{(4 - 9x)^2}$$

29. $f(x) = \frac{x^3 + 1}{x^3 - 1}$

$$f'(x) = \frac{-6x^2}{(x^3 - 1)^2}$$

30. $h(x) = \left(\frac{3x + 4}{6x - 1}\right)^3$

$$h'(x) = \frac{-81(3x + 4)^2}{(6x - 1)^4}$$

31. $g(x) = \frac{\sqrt{x^2}}{3x - 5}$

$$g'(x) = \frac{-x^{-10/3}}{3\sqrt{x}(3x - 5)^2}$$