

# Key

X	f(x)	f'(x)	g(x)	g'(x)
0	2	1	5	-4
1	3	2	3	-3
2	5	3	1	-2
3	10	4	0	-1

1. Find the derivative of  $f + 2g$  at  $x=3$

- a. -2
- b. 2
- c. 7
- d. 8
- e. 10

2. Find the derivative of  $f \cdot g$  at  $x=2$

- a. -20
- b. -7
- c. -6
- d. -1
- e. 13

3. Find the derivative of  $\frac{f(x)}{g(x)}$  at  $x=0$

- a. -13/4
- b. -13/25
- c. +13/25
- d. 13/16
- e. 13/4

4. Find the derivative of  $\sqrt{f(x)}$  at  $x=3$

- a.  $\frac{1}{2}$
- b.  $\frac{1}{2\sqrt{10}}$
- c. 2
- d.  $\frac{2}{\sqrt{10}}$
- e.  $4\sqrt{10}$

5. Find the derivative of  $f(g(x))$  at  $x=1$

- a. -12
- b. -6
- c. 4
- d. 6
- e. 12

6. Find the derivative of  $f(x^2)$  at  $x=1$

- a. 2
- b. 6
- c. 8
- d. 12
- e. 54

7. Find the derivative of  $\frac{1}{g}$  at  $x=1$

- a. -1/2
- b. -1/3
- c. -1/9
- d. 1/9
- e. 1/3

8. The derivative of  $y = \frac{2-x}{3x+1}$  is:

- a.  $-\frac{7}{(3x+1)^2}$
- b.  $\frac{6x-5}{(3x+1)^2}$
- c.  $-\frac{9}{(3x+1)^2}$
- d.  $\frac{7}{(3x+1)^2}$
- e.  $\frac{7-6x}{(3x+1)^2}$

13. Find the derivative of  $y = (3x^4 + 5)^{20}$

14. Find the derivative of  $\sqrt{\frac{2x-4}{x+1}}$

15. Find the derivative of  $y = x^4 \ln(x^2)$

16. Find the derivative of  $y = \frac{x+5}{\tan x}$

17. Find the derivative of  $y = \sqrt{3 \sin t}$

18. Find  $y''$  if  $y = (x^2 + 5)^5$

19. Find the values of  $x$  for which the graph of  $y = (2x + 1)^3$  has a tangent line which is perpendicular to the line  $x + 24y = 48$

20. The function  $s(t) = t^3 - 6t^2 - 15t + 4$  describes the position of a particle in motion along a line during the time interval  $-2 \leq t \leq 10$ , with  $s$  measured in feet and  $t$  measured in seconds.

- a. Find the velocity function and the acceleration function.
- b. Find the value of the velocity at the instant(s) when the acceleration is zero.
- c. Find the net displacement of the particle during the indicated time interval.
- d. Find the total distance traveled by the particle during the indicated time interval.

Review (table WKst):

$$\begin{aligned} 1) \quad h(x) &= f + 2g \\ h'(x) &= f' + 2g' \\ h'(3) &= 4 + 2(-1) = 2 \end{aligned}$$

$$\begin{aligned} 2) \quad h(x) &= f(x) \cdot g(x) \\ h'(x) &= f(x) \cdot g'(x) + g(x) \cdot f'(x) \\ h'(2) &= 5 \cdot -2 + 1 \cdot 3 = -10 + 3 = -7 \end{aligned}$$

$$\begin{aligned} 3) \quad h(x) &= \frac{f(x)}{g(x)} \\ h'(0) &= \frac{g(0)f'(0) - f(0)g'(0)}{(g(0))^2} = \frac{5 \cdot 1 - 2 \cdot -4}{5^2} = \frac{13}{25} \end{aligned}$$

$$\begin{aligned} 4) \quad y &= (f(x))^{1/2} \\ y' &= \frac{1}{2} (f(x))^{-1/2} \cdot f'(x) \\ \frac{1}{2} (10)^{-1/2} \cdot 4 &= \frac{2}{\sqrt{10}} \end{aligned}$$

$$\begin{aligned} 5) \quad y &= f(g(x)) \\ y' &= f'(g(x)) \cdot g'(x) \\ f'(3) \cdot -3 \\ 4 \cdot -3 &= -12 \end{aligned}$$

$$6) y = f(x^3)$$

$$y' = f'(x^3) \cdot 3x^2$$

$$2 \cdot 3(1)^2 = 6$$

$$7) y = \frac{1}{g} = g^{-1}$$

$$y' = -1(g)^{-2} \cdot g'$$

$$\frac{-1}{3^2} \cdot -3 = \frac{1}{3}$$

$$8) y = \frac{2-x}{3x+1}$$

$$y' = \frac{(3x+1)(-1) - [(2-x)(3)]}{(3x+1)^2}$$

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

$$y' = \frac{-7}{(3x+1)^2}$$

$$13) y = (3x^4 + 5)^{10}$$

$$y' = 10(3x^4 + 5)^9 \cdot 12x^3$$

$$y' = 120x^3(3x^4 + 5)^9$$

$$14) y = \left( \frac{3x-4}{x+1} \right)^{1/2}$$

$$y' = \frac{1}{2} \left( \frac{3x-4}{x+1} \right)^{-1/2} \cdot \left( \frac{(x+1)3 - [(3x-4)(1)]}{(x+1)^2} \right)$$

$$15) y = x^4 \cdot \sin(x^2)$$

$$y' = x^4 \cdot \cos(x^2) \cdot 2x + \sin(x^2) \cdot 4x^3$$

$$y' = 2x^5 \cos(x^2) + 4x^3 \sin(x^2)$$

$$16) y = \frac{x+5}{\tan x}$$

$$y' = \frac{\tan x(1) - [(x+5)\sec^2 x]}{(\tan x)^2}$$

$$17) y = (3\sin t)^{1/2}$$

$$y' = \frac{1}{2}(3\sin t)^{-1/2} \cdot 3\cos t$$

$$y' = \frac{3\cos t}{2\sqrt{3\sin t}}$$

$$18) y = (x^2 + 5)^5$$

$$y' = 5(x^2 + 5)^4 \cdot 2x$$

$$= 10x \cdot (x^2 + 5)^4$$

$$y'' = 10x(4(x^2 + 5)^3 \cdot 2x) + (x^2 + 5)^4 \cdot 10$$

$$y'' = 10(x^2 + 5)^4 + 80x^2(x^2 + 5)^3$$

$$y = (2x+1)^3$$

$$y' = 3(2x+1)^2 \cdot 2$$

$$y' = 6(2x+1)^2$$

$$y' = 6(4x^2 + 4x + 1)$$

$$y' = 24x^2 + 24x + 6 = 24$$

$$24x^2 + 24x - 18 = 0$$

$$6(4x^2 + 4x - 3) = 0$$

$$6(2x+3)(2x-1) = 0$$

$$x = -\frac{3}{2}, \frac{1}{2}$$

$$\perp \text{ to } x + 24y = 48$$

$$24y = -x + 48$$

$$y = -\frac{1}{24}x + 2$$

$$\perp \text{ slope} = 24$$



$$20) \quad s(t) = t^3 - 6t^2 - 15t + 4 \quad -2 \leq t \leq 10$$

$$a) \quad v(t) = 3t^2 - 12t - 15$$

$$a(t) = 6t - 12$$

$$b) \quad \begin{array}{l} 6t - 12 = 0 \\ t = 2 \end{array} \quad v(2) = -27$$

$$c) \quad \begin{array}{l} s(-2) = 2 \\ s(10) = 254 \end{array} \quad \text{displacement} = 252$$

$$d) \quad v(t) = 0$$

$$3t^2 - 12t - 15 = 0$$

$$3(t^2 - 4t - 5) = 0$$

$$3(t - 5)(t + 1) = 0$$

$$t = 5, -1$$

$t$	$s(t)$		
-2	2	>	10
-1	12	>	108
5	-96	>	350
10	254	>	350
			468

TDT: 468