

HW23: Unit 2 Review (DERIVATIVES)

Find the following.

1. $\lim_{h \rightarrow 0} \frac{(1+h)^{10} - 1}{h} =$

2. $\lim_{h \rightarrow 0} \frac{\sqrt[4]{16+h} - 2}{h} =$

3. $\lim_{x \rightarrow \pi} \frac{\cos(x) + 1}{x - \pi} =$

4. $\lim_{t \rightarrow 1} \frac{t^4 + t - 2}{t - 1} =$

5. If $f(x) = x^3 - 2x^2 + 7$, then $f'(-1) =$

6. If $f(x) = 2x - 11$, then $f'(7) =$

7. If $g(x) = \frac{x-3}{x+3}$, then $g'(5) =$

8. $\frac{d}{dx} \left(\frac{1}{x^3} - \frac{1}{x} + x^2 \right)$ at $x = -2$ is

9. If $y = \frac{4}{3-x^2}$, then $\frac{dy}{dx} =$

10. If $y = \frac{1}{\sqrt{x}}$, find y'

11. If $f(x) = 2 \tan^2 x$, find $f'(x)$

12. If $y = \sin \sqrt{2x}$, find $y'(x)$

13. If $f(x) = \frac{\tan x}{x}$, find $f'\left(\frac{\pi}{4}\right)$

14. If $f(x) = \cos x - \sin x$, then $f'\left(\frac{\pi}{3}\right) =$

15. If $f(x) = \sqrt{3x}$, then $f'(3) =$

16. The fourth derivative of $f(x) = (3x - 7)^4$ is

17. If $y = 3 \sin\left(\frac{x}{2}\right)$, then $\frac{d^2 y}{dx^2} =$

18. If $y = 2 \sin x \cos x$, then $\frac{d^2 y}{dx^2} =$

19. If $y^2 + 3xy = 19$, then $\frac{dy}{dx} =$

20. If $\tan(y - x) = x$ then $\frac{dy}{dx} =$

21. If $x^2 y + xy^2 = 6$, then, at the point $(1, 2)$, y' is

22. Find the equation of the line that is **tangent** to $x + \sqrt{xy} = 6$ at $(4, 1)$

23. Let $f(x) = 5x^3 - 3x - 1$. Find an equation of the tangent to $f(x)$ at $x = -1$.

24. Find the point(s) on the curve $y = 2x^3 - 3x^2 - 12x + 20$ where the tangent

(A) is perpendicular to $y = 1 - \frac{x}{24}$

(B) is parallel to $y = \sqrt{2} - 12x$

25. Find the point on the graph of $y = 4\sqrt{x}$ at which the tangent line has the same slope as the line through $(5, 1)$ and $(9, 3)$.

26. If $h(x) = f(g(x))$ find $h'(3)$. if $f'(3)=5, f'(7)=6, g'(3)=8, g(3)=7$

27. If $r(t) = \frac{f(t)}{g(t)}$ find $r'(2)$.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	3	4	5	6

Differentiate.

28. $y = \ln(\cos^3(3x))$

29. $y = (x^2 + 1)\sec x$

30. $y = \sqrt{\cos(5x)}$

31. $y = (1 + \sec^3(x))^{10}$

32. $h(x) = \sqrt{1-x^2} \arcsin x$

33. $y = \arctan(\cos \theta)$

34. $y = \tan^{-1}(x - \sqrt{1+x^2})$

35. $y = \frac{2x\sqrt{x^3-7x}}{(x+2)(3x-9)^2}$

36. $h(x) = 6^{3x}$

37. $y = (\sin x)^x$

Given $g(x) = f^{-1}(x)$, find the following.

38. $f(x) = \frac{4x}{x-1}$, find $g'(x)$

39. $f(x) = 2x^3$, find $g'(-2)$

Answer Key

1. 10

2. $\frac{1}{32}$

3. 0

4. 5

5. 7

6. 2

7. $\frac{3}{32}$

8. $\frac{-63}{16}$

9. $\frac{8x}{(3-x^2)^2}$

10. $\frac{-1}{2x^{\frac{3}{2}}}$

11. $4\tan x \sec^2 x$

12. $\frac{\cos \sqrt{2x}}{\sqrt{2x}}$

13. $\frac{8\pi - 16}{\pi^2}$

14. $\frac{-\sqrt{3}-1}{2}$

15. $\frac{1}{2}$

16. 1944

17. $\frac{-3}{4} \sin\left(\frac{x}{2}\right)$

18. $-8 \sin x \cos x$

19. $\frac{-3y}{2y+3x}$

20. $\cos^2(y-x) + 1$

21. $-\frac{8}{5}$

22. $y = -\frac{5}{4}x + 6$

23. $y = 12x + 9$

24. A) (3, 11) and (-2, 16))

B) (0, 20) and (1, 7)

25. (16, 16)

26. 48

27. $\frac{2}{25}$

28. $y' = -9 \tan(3x)$

29. $y' = 2x \sec x + (x^2 + 1) \sec x \tan x$

30. $y' = \frac{-5 \sin(5x)}{2\sqrt{\cos(5x)}}$

$$31. 30(1 + \sec^3 x)^9 \sec^3 x \tan x$$

$$32. y' = 1 - \frac{x \arcsin x}{\sqrt{1-x^2}}$$

$$33. y' = \frac{-\sin \theta}{1 + \cos^2 \theta}$$

$$34. y' = \frac{1}{2(1+x^2)}$$

$$35. y' = \left(\frac{1}{x} + \frac{3x^2 - 7}{2(x^3 - 7x)} - \frac{1}{x+2} - \frac{2}{x-3} \right) \left(\frac{2x\sqrt{x^3 - 7x}}{(x+2)(3x-9)^2} \right)$$

$$36. 3 \ln 6 \cdot 6^{3x}$$

$$37. y' = (x \cot x + \ln \sin x)(\sin x)^x$$

$$38. g'(x) = -\frac{4}{(x-4)^2}$$

$$39. g'(-2) = \frac{1}{6}$$