Study with the Prof: Derivative Rules

Problem Set 4: Mixed Levels of Difficulty

Do each problem on your own set of paper. Write out the problem as if you were doing it for an exam. Show all of your steps so that you can compare to the videos if you need to.

Using the derivative rules, find the derivative of the following functions:

Using either the formula associated with the definition of the derivative or the alternative formula, find the derivatives of the following functions. You should **not** use the derivative rules here, the point is to practice using the formula (and memorizing it if needed).

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

2. $y = \frac{1}{x^2}$

Using the derivative rules, find the derivative of the following functions:

3. $f(x) = 3x^4 - \frac{7}{x^3} + 4\sqrt{x}$

4. $g(x) = 4x^6 - 3(x^2 + \pi)$

5. $h(x) = \sin^2 x - \tan 4x$

6. $y = \frac{3}{\sqrt{x}+2}$

7. $f(x) = \left(\frac{3x}{x^2-3}\right)^3$

8. $y = \sqrt[3]{\frac{x^5-x^3}{x^4}}$

9. $g(x) = \frac{3}{\sin x - 3x^4}$

10. $y = x^3 e^{-\frac{1}{x}}$

11. $y = 5x \ln(2x + 1)$

12. $f(x) = (3x + 1)\sqrt{3x + 1}$

13. $y = \frac{3}{\cos^2 x} - \frac{2}{\cot x}$

14. $f(x) = \sin^{-1}\sqrt{x}$

15. $g(x) = \sin(3x - cos(4x + e^{6x}))$

16. $y = (\cos^2 x + \sin^2 x)^{24}$

17. $3xy - \sin y = 4$

18. $y^x = x^{\sin y}$

19. $\sqrt{xy} = 8$

20. $y = 3^{\sin x}$

21. $y = \log_7(4x + 1)$

22. $f(x) = (\ln x + \sin 3x)^{14}$

Answers

1. $f'(x) = -\frac{1}{3x^2}$
2. $y' = -\frac{2}{x^3}$
3. $f'(x) = 12x^3 + 21x^{-4} + 2x^{-\frac{1}{2}}$
4. $g'(x) = 24x^5 - 6x$
5. $h'(x) = 2\cos x \sin x - 4\sec^2 4x$
6. $y' = -\frac{3}{2(\sqrt{x}+2)^2\sqrt{x}}$
7. $f'(x) = -\frac{81x^2(x^2+3)}{(x^2-3)^4}$
8. $y' = \frac{x^{\frac{2}{3}}(x^2+1)}{3(x^5-x^3)^{\frac{2}{3}}}$
9. $g'(x) = -\frac{3(\cos x - 12x^3)}{(\sin x - 3x^4)^2}$
10. $y' = (3x^2 + x)e^{-\frac{1}{x}}$
11. $y' = 5\ln(2x+1) + \frac{10x}{2x+1}$
12. $f'(x) = \frac{9\sqrt{3x+1}}{2}$
13. $y' = \frac{6\sin x}{\cos^3 x} - \frac{2\csc^2 x}{\cot^2 x}$
14. $f'(x) = \frac{1}{2\sqrt{(x-)x^2}}$
15. $g'(x) = \cos(3x - \cos(4x + e^{6x}))(3 + \sin(4x + e^{6x})(4 + 6e^{6x}))$
16. $y' = 0$
17. $y' = \frac{3y}{\cos y - 3x}$
18. $y' = \frac{y\sin y - xy\ln y}{x^2 - xy\cos y\ln x}$
19. $y' = -\frac{y}{x}$
20. $y' = 3^{\sin x}\ln 3\cos x$
21. $y' = \frac{4}{(4x+1)\ln 7}$
22. $f'(x) = 14\left(3\cos 3x + \frac{1}{x}\right)(\sin 3x + \ln x)^{13}$

In case you need more review, here are other videos to watch (by problem). These videos will give you a much deeper review and/or more examples.

Questions 1, 2 Definition formula versus alternative formula https://youtu.be/S1U5RpqCUos, alternative formula examples https://youtu.be/vt9nQQdXkEc, definition version of the formula https://youtu.be/BMIkWYo3C7w

Question 3, 4 Basic derivative rules lesson https://youtu.be/-gfcRvqT3po, examples of basic derivatives https://youtu.be/9CVMFU5G2Fk

Question 5 Chain rule lesson https://youtu.be/FsxMB-5SDzk, chain rule examples with trig functions https://youtu.be/W1dan_IdHV0

Question 6 Basic derivative rules lesson (product rule, quotient rule) https://youtu.be/-gfcRvqT3po, examples of product rule and quotient rule https://youtu.be/lZy9UPWMQwE

Question 7, 8 Chain rule lesson https://youtu.be/FsxMB-5SDzk, basic derivative rules lesson (product rule, quotient rule) https://youtu.be/-gfcRvqT3po

Question 9 Examples of product rule and quotient rule https://youtu.be/lZy9UPWMQwE; examples of trig derivatives https://youtu.be/zsTWUdSeBXA

Question 10 Basic derivative rules lesson (product rule, quotient rule) https://youtu.be/-gfcRvqT3po, examples of product rule and quotient rule https://youtu.be/lZy9UPWMQwE

Question 11 Chain rule lesson https://youtu.be/FsxMB-5SDzk, examples of derivatives of general exponentials and logarithms https://youtu.be/zXk_LOxap0w

Question 12 Basic derivative rules lesson (product rule, quotient rule) https://youtu.be/-gfcRvqT3po, examples of product rule and quotient rule https://youtu.be/lZy9UPWMQwE

Question 13 Chain rule lesson https://youtu.be/FsxMB-5SDzk, chain rule examples with trig functions https://youtu.be/W1dan_IdHV0

Question 14 Chain rule lesson https://youtu.be/FsxMB-5SDzk, inverse trig function derivatives lesson https://youtu.be/vLe18VKxlqI, inverse trig function derivatives examples https://youtu.be/nFhdOwIbeWM

Question 15, 16 Chain rule lesson https://youtu.be/FsxMB-5SDzk, chain rule examples with trig functions https://youtu.be/W1dan_IdHV0

Question 17, 18, 19 Implicit differentiation lesson https://youtu.be/CTscFbd8ibk, implicit differentiation examples https://youtu.be/QMp3lIMaBY0, step-by-step example implicit differentiation with product rule https://youtu.be/1L7Da2gxwjM

Question 20 Logarithmic differentiation lesson https://youtu.be/qhdmF-1YJRI, logarithmic differentiation examples https://youtu.be/8XxLnvAi4b8

Question 21, 22 Chain rule lesson https://youtu.be/FsxMB-5SDzk, inverse trig function derivatives examples https://youtu.be/nFhdOwIbeWM, examples of derivatives of general exponentials and logarithms https://youtu.be/zXk_LOxap0w