Name: _____KEY_____

Math 180 - Homework #3

Write the ANSWERS ONLY on this page. Do your calculations/work elsewhere, then NEATLY transfer your answers to this page.

Differentiate #1 - 5 using the power rule. Do not simplify your answer (2pts. each)

ANSWER

1. $y = (x^3 + x^2 + 1)^5$

$y' = 5(x^3 + x^2 + 1)^4(3x^2 + 2x)$

2. $y = \sqrt{x^2 + 1}$

$y' = x(x^2 + 1)^{-1/2} = \dfrac{x}{\sqrt{x^2 + 1}}$

3. $f(t) = \dfrac{2}{t - 3t^3}$

$f'(x) = -2(t - 3t^3)^{-2}(1 - 9t^2) = \dfrac{2(9t^2 - 1)}{(t - 3t^3)^2}$

4. $\dfrac{d}{dP}\left(\sqrt{1 - 3P}\right)$

$\left(-\dfrac{3}{2}(1 - 3P)^{-1/2}\right)dp = -\dfrac{3\ dp}{2\sqrt{1 - 3P}}$

5. $\dfrac{d}{dx}(5x + 1)^4$

$20(5x + 1)^3\ dx$

Differentiate #6 - 10 using the product rule. Do not simplify your answer (2pts. each)

ANSWER

6. $y = (x + 1)(x^3 + 5x + 2)$

$y' = (x^3 + 5x + 2) + (x + 1)(3x^2 + 5)$

7. $y = x^2(7x - 1)^2$ (Power rule will be needed in conjunction with product rule)

$y' = 2x(7x - 1)^2 + 14x^2(7x - 1)$

8. $y = (2x + 1)^{5/2}(4x - 1)^{3/2}$ (Power rule will be needed in conjunction with product rule)

$y' = 5(2x + 1)^{3/2}(4x - 1)^{3/2} + 6(2x + 1)^{5/2}(4x - 1)^{1/2}$

9. $f(x) = (x^2 + 3)(x^2 - 3)^{10}$ (Power rule will be needed in conjunction with product rule)

$y' = 2x(x^2 - 3)^{10} + 20x(x^2 + 3)(x^2 - 3)^9$

10. $\dfrac{d}{dx}\left[x^7(3x^4 + 12x - 1)^2\right]$ (Power rule will be needed in conjunction with product rule)

$\left[7x^6(3x^4 + 12x - 1)^2 + 2x^7(12x^3 + 12)(3x^4 + 12x - 1)\right]dx$
$= \left[7x^6(3x^4 + 12x - 1)^2 + 24x^7(x^3 + 1)(3x^4 + 12x - 1)\right]dx$

Differentiate #11 - 15 using the quotient rule. Do not simplify your answer (2pts. each)

ANSWER

11. $y = \dfrac{x^2 + 2x - 1}{x^2 + 2x - 2}$

$y' = \dfrac{(2x + 2)(x^2 + 2x - 2) - (2x + 2)(x^2 + 2x - 1)}{(x^2 + 2x - 2)^2}$

12. $y = \dfrac{3x^2 + 5x + 1}{3 - x^2}$

$y' = \dfrac{(6x + 5)(3 - x^2) + 2x(3x^2 + 5x + 1)}{(3 - x^2)^2}$

13. $y = \dfrac{x+3}{(2x+1)^2}$ (Power rule will be needed in conjunction with quotient rule)
SIMPLIFY ANSWER COMPLETELY FOR THIS PROBLEM

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

$$-\frac{(2x+11)}{(2x+1)^3} = \frac{1}{(2x+1)^2} - \frac{4(x+3)}{(2x+1)^3}$$

14. $f(x) = \dfrac{7}{9} + \dfrac{x^2+x+1}{x^5+1}$ (Hint: What do we know about differentiating constants?)

$$f'(x) = \frac{(2x+1)(x^5+1) - 5x^4(x^2+x+1)}{(x^5+1)^2}$$

15. $\dfrac{d}{dx}\left(\dfrac{\sqrt{x}}{\sqrt{x}+4}\right)$ **SIMPLIFY ANSWER COMPLETELY FOR THIS PROBLEM**

$$y' = \frac{\frac{1}{2}x^{-\frac{1}{2}}\left(x^{\frac{1}{2}}+4\right) - \frac{1}{2}x^{\frac{1}{2}}\left(x^{-\frac{1}{2}}\right)}{\left(\sqrt{x}+4\right)^2} = \frac{2}{\sqrt{x}\left(\sqrt{x}+4\right)^2}$$

#16 – 20: Find $\dfrac{dy}{dx}$ by implicit differentiation. **Simplify** your answer completely (2pts. each) **ANSWER**

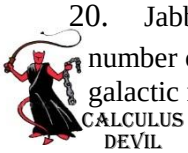
16. $x^2 - 2y^2 = 16$ $\quad y' = \dfrac{x}{2y}$

17. $x^2 - 2xy = 6$ (Product rule will be needed) $\quad y' = \dfrac{x-y}{x} = 1 - \dfrac{y}{x}$

18. $x^2y^2 - xy = 8$ (Product rule will be needed twice) $\quad y' = -\dfrac{y}{x}$

19. $x^{1/2} + y^{1/2} = 1$. (No fractional or negative exponents in answer) (Write answer in radical form only) $\quad y' = -\dfrac{\sqrt{y}}{\sqrt{x}}$

20. Jabba sells stuffed Ewoks according to $p + \frac{1}{6}x^3 = 48$, where p is the price and x is the number of Ewoks. How fast is the price dropping if Ewoks are being introduced into the galactic marketplace at 5 per week when there are already 4 stuffed Ewoks available? $\quad -\$40/week$



21. Yoda finds that his marginal costs for constructing light sabers is 0.04x + 150 dollars.
(A) If his fixed costs are \$500 per day, what would his cost function look like? (A) $C(x) = .02x^2 + 150x + 500$
(B) Find the cost of increasing his business from 10 sabers/day to 12 sabers/day. (B) \$300.88

22 – 23: Find the average value of the function f over the indicated interval [a,b] (2pts. each) **ANSWER**

22. $f(x) = 2x + 3$; [0,2] $\quad 5$

23. $f(x) = 2x^2 - 3$; [1,3] (Write answer as a fraction. No Decimals!) $\quad \dfrac{17}{3} = 5\frac{2}{3}$