Please show **all** your work! Answers without supporting work will not be given credit. Write answers in spaces provided.

Name:_

- Solutions
- 1. The rate of change of the population n(t) of a sample of bacteria is directly proportional to the number of bacteria present, so N'(t) = kN, where time t is measured in minutes. Initially, there are 210 bacteria present. If the number of bacteria after 5 hours is 360, find the growth rate k in terms of minutes. Round to four decimal places.

Recall N'= kN
$$\rightarrow$$
 N= Ce^{k+}
N(6)=210: 210=Ce^{k-0}
210=C \rightarrow N=210e^{K+}
N(5)=360: 360=210e^{K-5}
 $\frac{12}{7}=e^{5K}$
 $\ln(12/7)=5k$ $k=$ $\frac{1}{5}\ln(\frac{12}{7})$

2. Let y denote the mass of a radioactive substance at time t. Suppose this substance obeys the equation

$$y' = -18y$$

Assume that initially, the mass of the substance is y(0) = 20 grams. At what time t in hours does half the original mass remain? Round your answer to 3 decimal places.

$$y' = -18y \implies y = Ce^{-18t}$$

$$y(0) = 20 \implies 21 = Ce^{-18(0)}$$

$$20 = C \implies y = 28e^{-18t}$$

$$Vc \text{ want solve } \frac{1}{2}(20) = y(t) \text{ for t.}$$

$$10 = 20e^{-18t}$$

$$y_2 = e^{-18t}$$

$$1n(y_2) = -18t$$

$$\frac{\ln(y_2)}{-18} = t$$

3. Find the general solution to the differential equation:

$$\frac{dy}{dx} = \frac{3x^2}{y}$$
Rewrite: $y dy = 3x^2 dx$

$$5y ly = 53x^2 dx$$

$$4x^2 = x^3 + c$$

$$y^2 = 2x^3 + c$$

$$y = \pm 5x^3 + c$$

$$y = \pm 5x^3 + c$$

•

4. Find the general solution to the differential equation:

Rewrite
$$dy = 5y dx$$

 $dy = 5dx$
 $y = 5dx$
 $y = 5dx$
 $y = 5dx$
 $|n|y| = 5x + c$
 $|y| = e^{5x + c}$
 $t = y = e^{e^{5x}}$
 $y = e^{e^{5x}}$
 $y = e^{e^{5x}}$
 $y = e^{e^{5x}}$
 $y = e^{e^{5x}}$

5. Find the general solution to the differential equation:

$$\frac{dy}{dx} = \frac{-x}{y}$$
Rewrite: $y \, dy = -x \, dx$

$$\int y \, dy = \int -x \, dx$$

$$\frac{y^2}{2} = -\frac{x^2}{2} + c$$

$$y^2 = -x^2 + c$$

$$y = \pm \int c - x^2$$

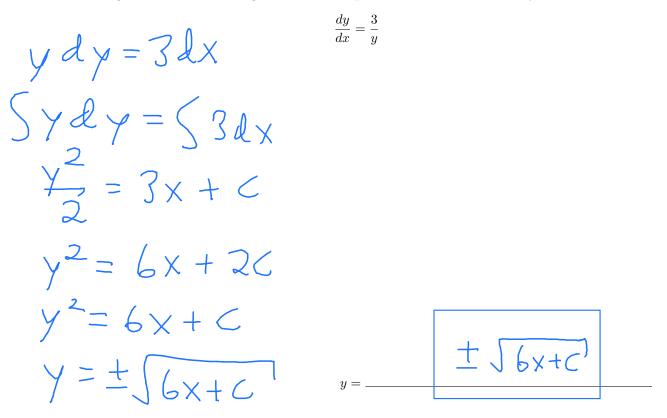
$$y = \pm \int c - x^2$$

6. Find the general solution to the given differential question. Use C as an arbitrary constant.

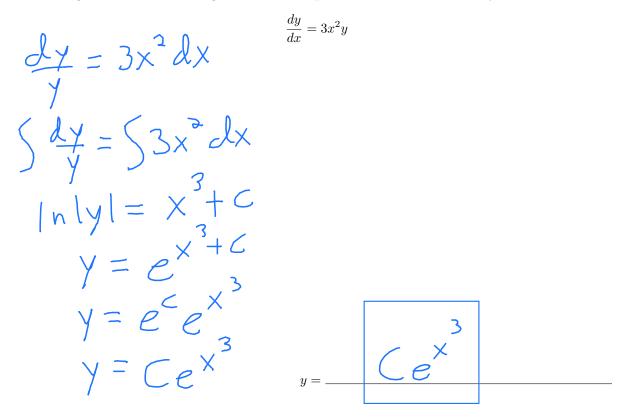
Note there are
$$2 wwys$$

to do this problem.
() Separation of Variables
D First-Order Linear Egn
By method 1,
 $\frac{dy}{dt} - 15y = 0$
 $1n |y| = 15t C$
 $y = e^{15t+C}$
 $y = Ce^{15t}$
 $y = Ce^{15t}$
 $y = Ce^{15t}$
 $y = Ce^{15t}$
 $y = Ce^{15t}$

7. Find the general solution to the given differential question. Use C as an arbitrary constant.



8. Find the general solution to the given differential question. Use C as an arbitrary constant.



9. Find the general solution to the given differential question. Use C as an arbitrary constant.

$$dy = 8e^{-4t}e^{-7}dt \qquad \frac{dy}{dt} = 8e^{-4t-y}$$

$$e^{7}dy = 8e^{-4t}dt$$

$$Se^{7}dy = 8e^{-4t}dt$$

$$e^{7} = \frac{8}{-4}e^{-4t} + C$$

$$e^{7} = -2e^{-4t} + C$$

$$y = \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=\frac{1}{2}} \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=\frac{1}{2}}$$

$$y = \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=\frac{1}{2}} \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=\frac{1}{2}}$$

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$$y = \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=\frac{1}{2}} \left[\ln\left(-2e^{-4t}+C\right)\right]^{y=$$

10. Find the particular solution to the differential equation.

$$\frac{dy}{dx} = \frac{3x+2}{2y} \text{ and } y(0) = 4$$

$$2y dy = (3x+2)dx$$

$$\int 2y dy = \int (3x+2)dx$$

$$y^{2} = \frac{3x^{2}}{2} + 2x + C$$

$$56 y^{2} = \frac{3x^{2}}{2} + 2x + 16$$
$$y = \pm \int \frac{3x^{2}}{2} + 2x + 16$$

when
$$y(0) = 4$$

 $y^{2} = 0 + 0 + C$
 $16 = C$

$$y = \frac{1}{2} + \frac{3x^2}{2} + 2x + 16$$

11. Find the particular solution to the differential equation.

$$\frac{dy}{dx} = \frac{5y}{6x+3} \text{ and } y(0) = 1$$

$$\frac{dy}{dx} = \frac{5}{6x+3} dX$$

$$\int \frac{dy}{y} = \int \frac{5}{6x+3} dX$$

$$\int \frac{dy}{y} = \int \frac{5}{6x+3} dX$$

$$\int \frac{dy}{dx} = \int \frac{5}{6x+3} dX$$

$$\int \frac{1}{6x+3} \frac{1}{6$$

12. Consider the following IVP:

$$\frac{dy}{dx} = 11x^2e^{-x^3}$$
 where $y = 10$ when $x = 2$

Find the value of the integration constant, C.

$$dy = 11x^{2}e^{-x^{3}}dx$$

$$Sdy = \int 11x^{2}e^{-x^{3}}dx$$

$$u = -x^{3}$$

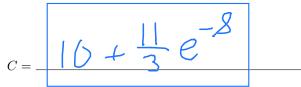
$$du = -3x^{3}dx$$

$$Y = \int -\frac{11}{3}e^{u}du$$

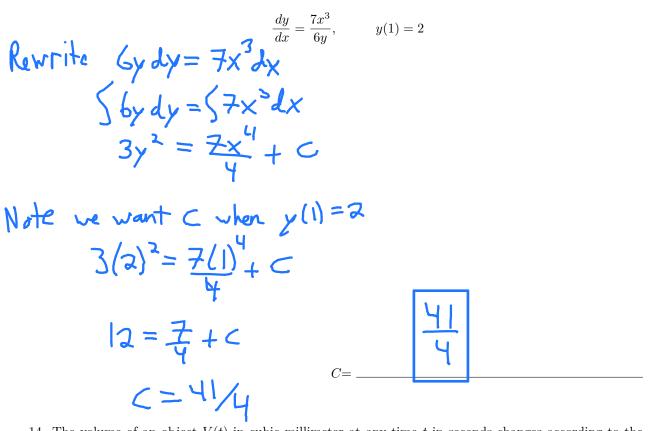
$$Y = -\frac{11}{3}e^{-x^{3}}+C$$

When
$$y = |D \ chd \ x = 2$$

 $|D = -\frac{11}{3}e^{-2^{3}} + C$
 $|O = -\frac{11}{3}e^{-8} + C$
 $C = 10 + \frac{11}{3}e^{-8}$



13. Calculate the constant of integration, C, for the given differential equation.



14. The volume of an object V(t) in cubic millimeter at any time t in seconds changes according to the model

$$\frac{dV}{dt} = \cos\left(\frac{t}{10}\right)$$

where V(0) = 5. Find the volume of the object at t = 3 seconds. Round to 4 decimal places.

Peurite
$$dV = cos(f_0)dt$$

 $\int dV = \int cos(f_0)dt$
 $V(3) = 10 \sin(f_0) + 5$
 $\nabla = 10 \sin(f_0) + c$
Find $C = \sqrt{V(0)} = 5$
 $\int = 10 \sin(f_0) + c$
 $C = 5$
 $\int = 10 \sin(f_0) + 5$
 $V(3) = 10 \sin(f_0) + 5$
 $\Sigma = 10 \sin(f_0) + 5$

15. What is the **integrating factor** of the following differential equation?

$$P(x) = \frac{2x+3}{x} \quad Q(x) = 10 \ln (x)$$

$$P(x) = \frac{2x+3}{x} \quad Q(x) = 10 \ln (x)$$

$$= e^{2} e^{3hx}$$

$$= e^{2} e^{3hx}$$

$$= e^{2} e^{1hx^{3}}$$

$$= e^{2} e^{1hx^{3}}$$

$$= e^{2} e^{1hx^{3}}$$

$$= e^{2} e^{1x}$$

$$= x^{3} e^{2}$$

$$= x^{3} e^{2}$$

$$= e^{2} e^{1x}$$

$$= x^{3} e^{2}$$

$$= x^{3} e^{2}$$

$$= e^{2} e^{1x}$$

16. What is the **integrating factor** of the following differential equation?

$$\frac{2y' + \left(\frac{6}{x}\right)y = 10\ln(x)}{Q}$$

$$y' + \frac{3}{X}y = 5\ln X$$

$$P(x) = \frac{3}{X}Q(x) = 5\ln x$$

$$u(x) = \exp[5\frac{3}{X}dx]$$

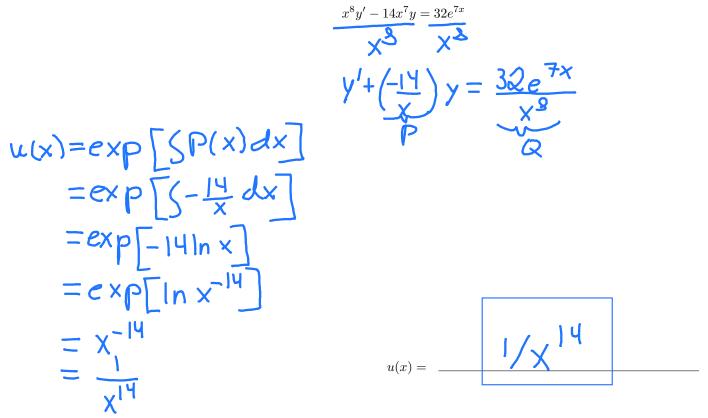
$$= \exp[5\ln x]$$

$$= \exp[5\ln x]$$

$$= x^{3}$$

$$u(x) = \frac{3}{X}$$

17. What is the **integrating factor** of the following differential equation?



18. What is the **integrating factor** of the following differential equation?

$$\frac{(x+1)\frac{dy}{dx} - 2(x^2 + x)y = (x+1)e^{x^2}}{(x+1)}$$

$$\frac{dy}{dx} - \frac{\partial_x (x+1)}{(x+1)} y = e^{x^2}$$

$$\frac{dy}{dx} + (-\partial_x) \cdot y = e^{x^2}$$

$$\int_x (x) = e^{x}\rho[\int \rho(x) dx]$$

$$= e^{x}\rho[\int -\partial_x dx]$$

$$= e^{x}\rho[-x^2]$$

$$u(x) = \boxed{\begin{array}{c} -\chi^2 \\ e \end{array}}$$

19. What is the **integrating factor** of the following differential equation?

$$y' + \cot(x) \cdot y = \sin^{2}(x)$$

$$u(x) = e \times p \left[\int P(x) \, dx \right]$$

$$= e \times p \left[\int \frac{\cos x}{\sin x} \, dx \right]$$

$$u = \sin x$$

$$du = \cos x \, dx$$

$$= e \times p \left[\int \frac{du}{u} \right]$$

$$= e \times p \left[\ln u \right]$$

$$u(x) = e \times p \left[\ln x \right]$$

$$u(x) = \int \sin x$$

$$u(x) = \int \frac{\sin x}{\cos x} \, dx$$

20. What is the **integrating factor** of the following differential equation?

$$u(x) = e \times p \left[\int p(x) dx \right]$$

$$= e \times p \left[\int f(x) dx \right]$$

$$= e \times p \left[\int \frac{\sin x}{\cos x} dx \right]$$

$$= e \times p \left[\int \frac{\sin x}{\cos x} dx \right]$$

$$= e \times p \left[-\int \frac{du}{u} \right]$$

$$= e \times p \left[-\ln u \right]$$

$$u(x) = e \times p \left[-\ln (\cos x) \right]$$

$$= e \times p \left[\ln(\cos x)^{-1} \right]$$

$$= (\cos x)^{-1} = Se \times x$$

$$u(x) = \frac{Se \times x}{10}$$

21. Find the general solution of the following differential equation.

 $\frac{dy}{dx} + (4x-1)y = 8x-2$ Q(x) = 8x - 2P(x) = 4x - 1 $u(x) = exp \left| \zeta (4x-1) dx \right|$ $= e \times p \quad 2x^2 - x$ $= e^{2x^2-x}$ $y u(x) = \int Q(x)u(x)dx + C$ $y e^{2x^{2}-x} = \int (8x-2)e^{2x^{2}-x} dx + C$ $u = 2x^2 - X$ du = 4x - 1 dx $ye^{2x^{-}x} = \left(\frac{8x-3}{4x-1}e^{u}du+c\right)$ $\gamma e^{2x^2-x} = \left(\frac{a(4x-1)}{4x-1}e^{4}du+c\right)$

 $2x^{2} - x = \langle 2e^{2} du + c \rangle$

 $e^{dx-x} = 2e^{x} + C$

 $e^{2x^{2}-x} = 2e^{2x^{2}-x} + C$

$$y = \frac{2e^{2x^2 - x} + 6}{e^{2x^2 - x}}$$
$$y = 2 + 6e^{-(2x^2 - x)}$$
$$= 2 + 6e^{x - 2x^2}$$

Note there are 2 ways to do this problem.

1) Separation of Variables

1) First-Order Linear Egn

 $2+Ce^{x-2x^2}$

22. Find the particular solution to the differential equation.

$$\frac{dy}{dz} = 6x^{2}(y+4) \text{ and } y(0) = 3$$

$$y' = (6x^{2}y + 24) x^{2}$$

$$y' - (6x^{3}y) = 24 x^{2}$$

$$P(x) = -6x^{2} \quad (x(x) = 24)x^{2}$$

$$u(x) = exp[(5 - 6x^{2}dx]]$$

$$= e^{-2x^{3}}$$

$$y \cdot u(x) = \int Q(x)u(x) dx + c$$

$$y = e^{-2x^{3}} = \int 24x^{2}e^{-2x^{3}} dx + c$$

$$u(x) = x^{3} = \int -4e^{u} dx + c$$

$$y = e^{-2x^{3}} = -4e^{u} + c$$

$$y = -2x^{3} = -4e^{u} + c$$

$$y = -4x^{2} = -4e^{u} + c$$

23. Solve the initial value problem.

$$x^4y' + 4x^3 \cdot y = 10x^9$$
 with $f(1) = 23$

$$\frac{x^{4}y' + 4x^{3}y}{x^{4}} = \frac{10x^{4}}{x^{4}}$$

$$\frac{y' + \frac{4}{x} \cdot y}{x^{4}} = 10x^{5}$$

$$P(x) = \frac{4}{x} \quad Q(x) = 10x^{5}$$

$$u(x) = exp[\langle P(x)dx \rangle]$$

$$= exp[\langle Y dx \rangle]$$

$$= exp[(y + 1)nx]$$

$$= exp[(y + 1)nx]$$

$$= x^{4}$$

$$y \cdot u(x) = \int Q(x)u(x)dx + C$$

$$y \cdot x^{H} = \int |0x^{5}x^{H}dx + C$$

$$y \cdot x^{H} = \int |0x^{9}dx + C$$

$$y \cdot x^{H} = x^{10} + C$$

$$y = \frac{x^{10}}{x^{14}} + \frac{C}{x^{4}}$$

$$y = x^{6} + \frac{C}{x^{4}}$$

$$23 = |+ \frac{c}{1} \\ 22 = c \\ y = x + \frac{22}{x^{4}}$$

$$y = \frac{x^{b} + \frac{22}{x^{4}}}{x^{4}}$$

24. (a) Use summation notation to write the series in compact form.

$$1 - 0.6 + 0.36 - 0.216 + \dots$$

$$= 1 - \frac{6}{10} + \frac{36}{100} - \frac{316}{1000} + \dots$$

$$= 1 - \frac{6}{10} + \left(\frac{6}{10}\right)^2 - \left(\frac{6}{10}\right)^3 + \dots$$

$$= \sum_{h=0}^{\infty} (-1)^n \left(\frac{6}{10}\right)^n$$

$$= \sum_{h=0}^{\infty} \left(\frac{-6}{10}\right)^n$$
Answer:

(b) Use the sum from (a) and compute the sum.

$$\sum_{n=0}^{\infty} \left(\frac{-6}{10}\right)^n = \frac{1}{1 - \left(-\frac{6}{10}\right)} = \frac{1}{1 + \frac{6}{10}} = \frac{1}{1 + \frac{6}{$$

Answer:__

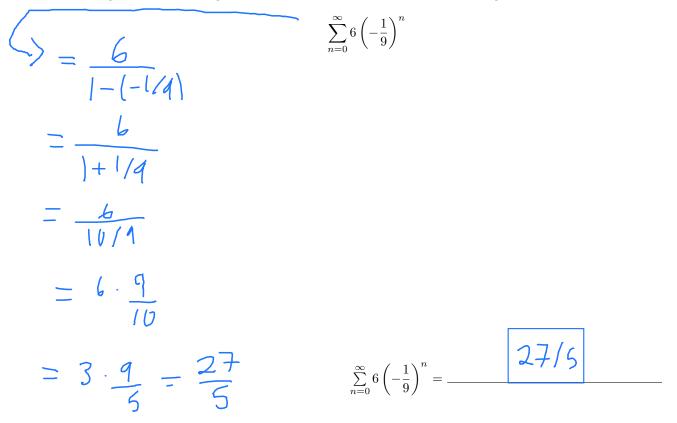
25. If the given series converges, then find its sum. If not, state that it diverges.

$$\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^n$$
Note $r=3/2$ and
 $\left|\frac{3}{2}\right| < 1$ is false
So the sum diverges

$$\sum_{n=0}^{\infty} \left(\frac{3}{2}\right)^n =$$

5/2

26. If the given series converges, then find its sum. If not, state that it diverges.



27. If the given series converges, then find its sum. If not, state that it diverges.

$$\sum_{n=0}^{\infty} \left(\frac{7}{4^n}\right)$$

$$= \sum_{n=0}^{\infty} \frac{7}{(4^n)}$$

$$= \frac{7}{1-1/4}$$

$$= \frac{7}{3/4}$$

$$= 7 \cdot \frac{4}{3} = \frac{28}{3}$$

$$\sum_{n=0}^{\infty} \left(\frac{7}{4^n}\right) = -28/3$$

28. Compute

$$\sum_{n=1}^{\infty} \frac{5^{n+2}}{6^n}$$

$$= \frac{5}{6} + \frac{5}{6^2} + \frac{5}{6^3} + \dots$$

$$= \frac{5}{6} + \left(\frac{5}{6}\right)^2 + \dots$$

$$= \frac{125}{6} \sum_{n=0}^{\infty} \left(\frac{5}{6}\right)^n = \frac{125}{6} \cdot \frac{1}{1-5/6}$$

$$= \frac{125}{6} \cdot \frac{1}{1/6} = \frac{125}{6} \cdot \frac{6}{1} = 125$$

$$\sum_{n=1}^{\infty} \frac{5^{n+2}}{6^n} = -\frac{125}{6}$$

29. Compute

$$\sum_{n=0}^{\infty} \frac{(-2)^{n}}{3^{2n+1}}$$

$$= \sum_{n=0}^{\infty} \frac{(-2)^{n}}{3^{2n+1}}$$

$$= \sum_{n=0}^{\infty} \frac{1}{3} \cdot \frac{(-2)^{n}}{(3^{2})^{n}}$$

$$= \sum_{n=0}^{\infty} \frac{1}{3} \left(-\frac{2}{9}\right)^{n}$$

$$= \frac{1/3}{1-(-2/9)}$$

$$= \frac{1/3}{1+2/9}$$

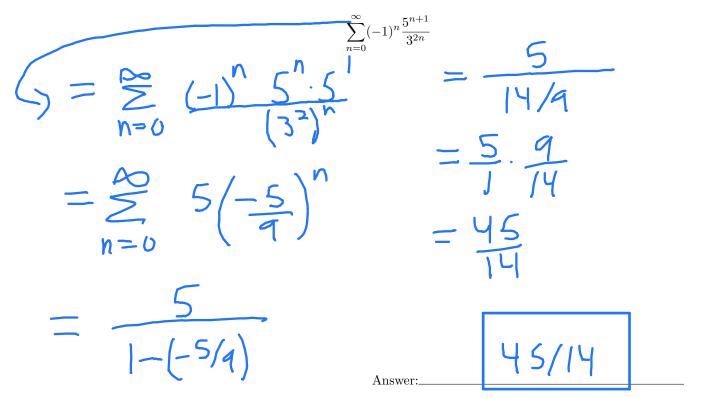
$$= \frac{1/3}{1+2/9}$$

$$\sum_{n=0}^{\infty} \frac{(-2)^{n}}{3^{2n+1}} = \frac{3/11}{11}$$

$$= \frac{1}{3} \cdot \frac{9}{11}$$

$$= \frac{16}{3^{2}}$$

30. Evaluate the sum of the following infinite series.



31. Evaluate the sum of the following infinite series.

$$\sum_{n=1}^{\infty} \left(\frac{3^{n-1}}{4^n} + \frac{(-1)^{n+1}}{9^n} \right)$$

$$= \sum_{n=1}^{\infty} \left(\frac{3^{-1}}{1} \cdot \frac{3^n}{4^n} + \frac{(-1)^{-1}}{1} \cdot \frac{(-1)^n}{9^n} \right)$$

$$= \frac{1}{3} \left(\frac{1}{3} \left(\frac{3}{4} \right)^n - \left(-\frac{1}{4} \right)^n \right)$$

$$= \frac{1}{3} \left(\frac{3}{4} \right)^1 - \left(-\frac{1}{4} \right)^1$$

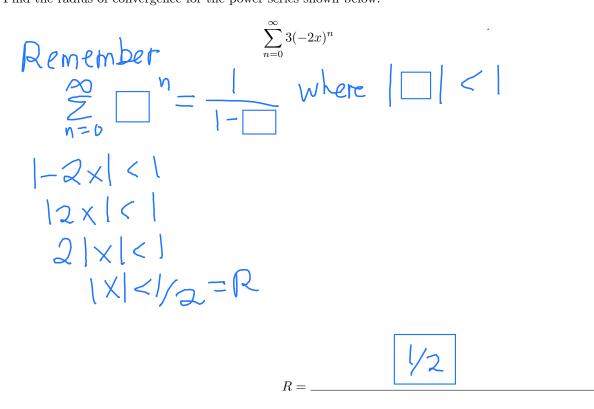
$$= \frac{1}{3} \left(\frac{3}{4} \right)^2 - \left(-\frac{1}{4} \right)^2$$

$$+ \frac{1}{3} \left(\frac{3}{4} \right)^2 - \left(-\frac{1}{4} \right)^2$$

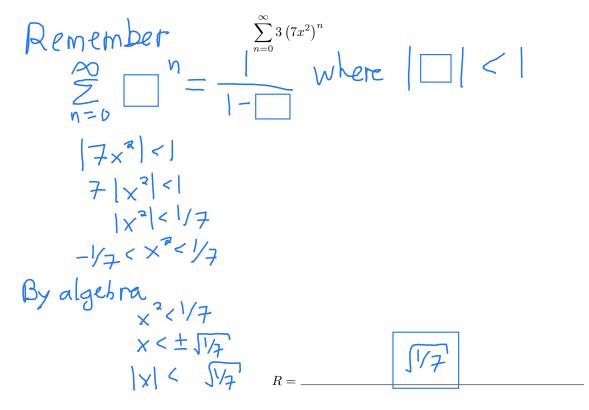
$$+ \dots$$

$$\frac{1}{q} + \frac{(-1)^{n+1}}{q^n} = \frac{1}{3} \left(\frac{3}{4} \right) \left[1 + \left(\frac{3}{4} \right) + \left(\frac{3}{4} \right)^2 + \dots \right] \\ - \left(\frac{1}{2} \right) \left[1 + \left(-\frac{1}{4} \right) + \left(\frac{3}{4} \right)^2 + \dots \right] \\ - \left(\frac{1}{2} \right) \left[1 + \left(-\frac{1}{4} \right) + \left(-\frac{1}{4} \right)^2 + \dots \right] \\ = \frac{1}{12} \sum_{h=0}^{\infty} \left(\frac{3}{11} \right)^h + \frac{1}{4} \sum_{h=0}^{\infty} \left(-\frac{1}{4} \right)^h \\ = \frac{1}{12} \cdot \frac{1}{1-3/4} + \frac{1}{4} \cdot \frac{1}{1-(-1/4)}$$
Answer:

32. Find the radius of convergence for the power series shown below.



33. Find the radius of convergence for the power series shown below.



34. Use the first three terms of the powers series representation of the $f(x) = \frac{3x}{10+2x}$ to estimate f(0.5). Round to 4 decimal places.

$$\frac{3\times}{10(1+\frac{2}{10}\times)} = \frac{3\times}{16} \cdot \frac{1}{1-(-\frac{2}{10}\times)}$$

$$\frac{1}{1-(-\frac{2}{10}\times)} = \sum_{n=0}^{\infty} \left(-\frac{2}{10}\times\right)^{n}$$

$$f(x) = \frac{3\times}{10} \cdot \frac{1}{1-(-\frac{2}{10}\times)} = \frac{3\times}{10} \sum_{n=0}^{\infty} \left(-\frac{2}{10}\times\right)^{n}$$

$$f(x) = \frac{3\times}{10} \sum_{n=0}^{\infty} \left(-\frac{1}{10}\right)^{n} \sum_{n=0}^{\infty} \left(-\frac{2}{10}\times\right)^{n}$$

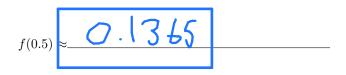
$$f(x) = \frac{3\times}{10} \sum_{n=0}^{\infty} \left(-\frac{1}{10}\right)^{n} \frac{2^{n} \cdot 3^{1} \times n}{10^{n}}$$

$$= \sum_{n=0}^{\infty} \left(-\frac{1}{10}\right)^{n} \frac{2^{n} \cdot 3 \cdot (0.5)^{n+1}}{10^{n+1}}$$

$$f(0.5) = \sum_{n=0}^{\infty} \left(-\frac{1}{10}\right)^{n} \frac{2^{n} \cdot 3 \cdot (0.5)^{n+1}}{10^{n+1}}$$

$$= \frac{3(0.5)}{10} \cdot \frac{2 \cdot 3(0.5)^{2}}{10^{2}} + \frac{2^{2} \cdot 3(0.5)^{2}}{10^{3}}$$

$$\approx 0.1365$$



35. Express $f(x) = \frac{3}{1+2x}$ as a power series and determine it's radius of converge.

$$\frac{3}{1+2x} = \frac{3}{1} \cdot \frac{1}{1+2x} = \frac{3}{1} \cdot \frac{1}{1-(-2x)}$$

$$\frac{1}{1-(-2x)} = \sum_{n=0}^{\infty} (-2x)^n \text{ where } |-2x| < 1$$

$$f(x) = \frac{3}{1-(-2x)} = 3 \sum_{n=0}^{\infty} (-3x)^n \text{ where } 2|x| < 1$$

$$= \sum_{n=0}^{\infty} 3(-1)^n 2^n x^n \text{ where } |x| < \frac{1}{2}$$

$$\frac{3}{1+2x} = \frac{1}{2}$$

$$R = \frac{1}{2}$$

36. Express
$$f(x) = \frac{5x}{3+2x^2}$$
 as a power series and determine it's radius of converge.

$$\frac{5\times}{3(1+2x^2/3)} = \frac{5\times}{3} \cdot \frac{1}{1-(-(2x^2/3))} = \frac{5\times}{3} \cdot \frac{1}{1-(-(2x^2/3))} + \frac{2}{1-(-(2x^2/3))} + \frac{2}{3} \cdot \frac{2}{3} + \frac{2}{3} \cdot \frac{1}{1-(-2x^2/3)} = \frac{5\times}{3} \cdot \frac{2}{3} \cdot \frac{1}{1-(-2x^2/3)} + \frac{2}{3} \cdot \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} \cdot \frac{2}{3} - \frac{5\times}{3} \cdot \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} \cdot \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{1}{3} + \frac{5\times}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{5\times}{3} + \frac{2}{3} + \frac{5\times}{3} +$$

37. What are the first 3 non-zero terms of the Maclaurin series representation of the follow?

$$Sin \times = \sum_{n=\nu}^{\infty} \frac{(-1)^{n}}{(2n+1)!} x^{2n+1}$$

$$Sin (x^{3/2}) = \sum_{n=0}^{\infty} \frac{(-1)^{n}}{(2n+1)!} (x^{3/2})^{2n+1}$$

$$= \sum_{n=\nu}^{\infty} \frac{(-1)^{n}}{(2n+1)!} x^{3n+3/2}$$

$$\int \sin(x^{3/2}) dx$$

$$\leq \prod_{n=0}^{\infty} \left(\chi^{3/2} \right) dx = \int \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} \chi^{3n+\frac{3}{2}} dx$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} \int \chi^{3n+\frac{3}{2}} dx$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} \frac{\chi^{3n+\frac{5}{2}}}{3n+\frac{5}{2}}$$

$$= \frac{\chi^{5/2}}{5/2} - \frac{\chi^{11/2}}{6 \cdot (\xi+5/2)} + \frac{\chi^{17/5}}{5! (6+\frac{5}{2})}$$

$$\int \sin(x^{3/2}) dx = \frac{\chi^{5/2}}{2} - \frac{\chi^{11/2}}{6 \cdot (\xi+5/2)} + \frac{\chi^{17/5}}{5! (6+\frac{5}{2})}$$

38. Evaluate the following indefinite integral as a series. [Leave your answer as a sum.]

$$e^{X} = \sum_{n=0}^{\infty} \frac{x^{n}}{n!} \qquad \int_{5e^{5x^{3}}dx} \\ e^{5x^{3}} = \sum_{h=0}^{\infty} \frac{(5x^{3})^{n}}{n!} = \sum_{n=1}^{\infty} \frac{5^{n}x^{3n}}{n!} \\ 5e^{5x^{3}} = 5\sum_{n=0}^{\infty} \frac{5^{n}x^{3n}}{n!} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n} \\ \int 5e^{5x^{3}}dx = \int_{n=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n} dx \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \int_{1}^{x^{3n}}dx \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \int_{1}^{x^{3n}}dx = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} \int_{1}^{5e^{5x^{3}}dx} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} \cdot \frac{x^{3n+1}}{(3n+1)} = \sum_{h=0}^{\infty} \frac{5^{n+1}}{n!} x^{3n+1} \\ = \sum_{h=$$

39. Use a power series to approximate the definite integral using the first 3 terms of the series.

$$\frac{x}{5+x^{6}} = \frac{x}{5-(-x^{6})} = \frac{x}{5\left[1-(-x^{6}/5)\right]} = \frac{x}{5} \cdot \frac{1}{1-(-x^{6}/5)}$$

$$\frac{1}{1-(-x^{6}/5)} = \frac{x}{5} \cdot \left(-\frac{x^{2}}{5}\right)^{h} = \frac{x}{5} \cdot \frac{1}{1-(-x^{6}/5)}$$

$$\frac{x}{5} \cdot \frac{1}{1-(-x^{6}/5)} = \frac{x}{5} \cdot \frac{x^{2}}{5} \cdot \frac{(-1)^{h} x^{6n}}{5^{h}} = \frac{x}{5} \cdot \frac{(-1)^{h} x^{6n+1}}{5^{h}}$$

$$\frac{x}{5} \cdot \frac{1}{1-(-x^{6}/5)} = \frac{x}{5} \cdot \frac{x^{2}}{5^{n}} \cdot \frac{(-1)^{h} x^{6n}}{5^{h}} = \frac{x}{5^{2}} \cdot \frac{(-1)^{h} x^{6n+1}}{5^{n+1}}$$

$$\int_{0}^{0.2^{1}} \frac{x}{5+x^{1}} \, dx = \int_{0}^{0.2^{1}} \frac{x}{5^{n}} \cdot \frac{(-1)^{h} x^{6n+1}}{5^{n+1}} \, dx$$

$$= \sum_{h=0}^{\infty} \frac{(-1)^{h}}{5^{n+1}} \int_{0}^{0.2^{1}} \frac{x^{6n+1}}{5^{n+1}} \, dx$$

$$= \sum_{h=0}^{\infty} \frac{(-1)^{h}}{5^{n+1}} \cdot \frac{x^{6n+1}}{5^{n+1}} \, dx$$

$$= \left(\frac{1}{5} \cdot \frac{x^{2}}{2} - \frac{1}{5^{2}} \cdot \frac{x^{8}}{8} + \frac{1}{5^{3}} \cdot \frac{x^{1}}{1^{N}}\right) \right]_{0}^{0.2^{1}}$$

$$\approx 0.00576$$

$$\int_{0}^{0.24} \frac{x}{5+x^{6}} \, dx \approx \boxed{0.00576}$$

40. Use a power series to approximate the definite integral using the first 4 terms of the series. Round to 5 decimal places. $c_{0.11}^{0.11} = 1$

$$\frac{1}{|x^{4}|} = \frac{1}{|-(-x^{4})|} = \sum_{n=0}^{\infty} (-x^{4})^{n} = \sum_{n=0}^{\infty} (-1)^{n} x^{4n}$$

$$\int_{0}^{0.11} \frac{1}{|x^{4}|} dx = \int_{0}^{0.11} \sum_{n=0}^{\infty} (-1)^{n} x^{4n} dx$$

$$= \sum_{n=0}^{\infty} (-1)^{n} \int_{0}^{0.11} x^{4n} dx$$

$$= \sum_{n=0}^{\infty} (-1)^{n} \int_{0}^{0.11} x^{4n} dx$$

$$= \sum_{n=0}^{\infty} (-1)^{n} \frac{x^{4n+1}}{|x^{n+1}|} \int_{0}^{0.11} \int_{0}^{0.11} \frac{1}{1+x^{4}} dx \approx$$

$$\int_{0}^{0.11} \frac{1}{1+x^{4}} dx \approx$$

$$\int_{0}^{0.11} \frac{1}{1+x^{4}} dx \approx$$

41. Use a power series to approximate the definite integral using the first 3 terms of the series. Round to 5 decimal places.

$$e^{\chi} = \sum_{n=0}^{\infty} \frac{|x|^{n}}{n!} \qquad \int_{0}^{0.23} e^{-x^{2}} dx$$

$$e^{-\chi^{2}} = \sum_{n=0}^{\infty} \frac{(-x^{2})^{n}}{n!} = \sum_{n=0}^{\infty} \frac{(-1)^{n}}{n!} x^{2n}$$

$$\int_{0}^{0.23} e^{-\chi^{2}} dx = \int_{0}^{0.23} \sum_{n=0}^{\infty} \frac{(-1)^{n}}{n!} x^{2n} dx$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^{n}}{n!} \int_{0}^{0.23} x^{2n} dx$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^{n}}{n!} \int_{0}^{0.23} x^{2n} dx$$

$$= \sum_{n=0}^{\infty} \frac{(-1)^{n}}{n!} x^{2n+1} \int_{0}^{0.23}$$

$$= \left(\frac{\chi}{1} - \frac{\chi^{3}}{1!} + \frac{\chi^{5}}{2!} \right) \right)_{0}^{0.23}$$

$$= \int_{0}^{0.23} e^{-x^{2}} dx \approx 0.246$$

42. Use a power series to approximate the definite integral using the first 4 terms of the series. Round to 5 decimal places.

$$\int_{0}^{0.45} 4x \cos(\sqrt{x}) dx$$

$$C \cup S(x) = \sum_{h=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{2n}$$

$$C \cup S(Jx^{-}) = \sum_{h=0}^{\infty} \frac{(-1)^{n}}{(2h)!} (x^{1/3})^{2n}$$

$$= \sum_{h=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n}$$

$$= \sum_{h=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n}$$

$$= \int_{0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n}$$

$$= \int_{x=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n}$$

$$= \int_{x=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n}$$

$$= \int_{x=0}^{\infty} \frac{(-1)^{n}}{(2h)!} \times^{n+1}$$

$$= \int_{0}^{\infty} \frac{(-1)^{n}}{(2h)!} \cdot 4x^{n+1}$$

$$= \int_{0}^{\infty} \frac{(-1)^{n}}{(2h)!} \cdot 4x^{n+1} dx$$

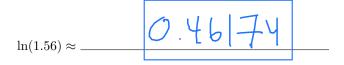
43. Use the first 3 terms of the Macluarin series for $f(x) = \ln(1+x)$ to evaluate ln(1.56). Round to 5 decimal places.

$$\ln(1+x) = \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n} x^{n}$$
Note $1.56 = 1 + 3.51$

$$\ln(1+0.56) = \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n} (0.56)^{n}$$

$$= 0.56 - (0.56)^{2} + (0.51)^{3}$$

$$= 0.56 - (0.56)^{2} + (0.51)^{3}$$



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44. Use the first 4 terms of the Macluarin series for $f(x) = \sin(x)$ to evaluate $\sin(0.75)$. Round to 5 decimal places.

$$\sin(x) = \sum_{h=0}^{\infty} \frac{(-1)^{h} x^{h+1}}{(2n+1)!}$$

$$\sin(0.75) = \sum_{h=0}^{\infty} \frac{(-1)^{h} (0.75)^{2n+1}}{(1n+1)!} = \frac{0.75}{1!} - \frac{(0.75)^{3}}{3!} + \frac{(0.75)^{6}}{5!} - \frac{(0.75)^{7}}{7!}$$

$$\sin(0.75) \approx \frac{0.74}{5!}$$

45. Find the domain of

$$f(x,y) = \frac{\sqrt{x+y-1}}{\ln(y-11)-9}$$

$$\ln\left(?\right) \longrightarrow ? > 0$$

$$\ln(y-11) \longrightarrow y-11 > 0$$

$$y > 11$$

$$\begin{aligned} & \int \overrightarrow{?} \rightarrow \overrightarrow{?} \ge 0 \\ & \int x + y - 1 \xrightarrow{?} x + y - 1 \ge 0 \\ & x + y \ge 1 \end{aligned}$$

$$\begin{aligned} & \frac{1}{?} \rightarrow \overrightarrow{?} \ne 0 \\ & \ln(y - 11) - 9 \ne 0 \\ & \ln(y - 11) \ne 9 \\ & y - 11 \ne e^{9} \\ & y \ne e^{9} + 11 \end{aligned}$$

$$\lim_{x \to y} = \frac{\left\{ (x, y) \setminus x + y^{2} \right\} + y^{2} + y^{$$

Domain

46. Find the domain of

$$f(x,y) = \frac{\ln(x^2 - y + 3)}{\sqrt{x - 6}}$$

$$f(x,y) = \frac{\ln(x^2 - y + 3)}{\sqrt{x - 6}}$$

$$f(x,y) = \frac{\ln(x^2 - y + 3)}{\sqrt{x - 6}}$$

$$f(x,y) = \frac{\ln(x^2 - y + 3)}{\sqrt{x - 6}}$$

$$\frac{1}{\sqrt{x-6}} \rightarrow \frac{1}{\sqrt{x-6}} \rightarrow \frac{1}$$

Domain =
$$\frac{\left\{\left(X, \gamma\right)\right\} \times \left(X, \gamma\right)}{\left(X, \gamma\right)} \times \left(X, \gamma\right) \times \left(X,$$

47. Describe the indicated level curves f(x, y) = C

$$f(x,y) = \ln(x^2 + y^2)$$
 $C = \ln(36)$

- (a) Parabola with vertices at (0,0)
- (b) Circle with center at $(0, \ln(36))$ and radius 6
- (c) Parabola with vertices at $(0, \ln(36))$
- (d) Circle with center at (0,0) and radius 6
- (e) Increasing Logarithm Function

48. What do the level curves for the following function look like?

$$f(x,y) = \ln(y - e^{5x})$$

- (a) Increasing exponential functions
- (b) Rational Functions with x-axis symmetry
- (c) Natural logarithm functions
- (d) Decreasing exponential functions
- (e) Rational Functions with y-axis symmetry
- 49. What do the level curves for the following function look like?

$$f(x,y) = \sqrt{x^2 + y^2}$$

- (a) Lines
- (b) Parabolas

- (d) Point at the origin
- (e) Ellipses
- (f) Hyperbolas
- 50. What do the level curves for the following function look like?

$$f(x,y) = \cos(y+4x^2)$$

- (a) Lines
- (b) Parabolas
- (c) Circles
- (d) Point at the origin
- (e) Ellipses
- (f) Hyperbolas

$$cos(y+4x^{2})=c$$

 $y+4x^{2}=cos^{-1}(c)$
 $y+4x^{2}=c$
 $y=-4x^{2}+c$

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 $ln(y-e^{5x}) = C$ $y-e^{5x} = e^{C}$ $y-e^{5x} = C$ $y = e^{5x} + C$

 $\ln(x^2+y^2) = \ln(36)$

X=+1,=36

 $\chi^2 + \gamma^2 = 6^2$

 $\sqrt{\chi^2 + \gamma^2} = C$ $\chi^2 + \gamma^2 = C^2$

51. For the following function f(x, y), evaluate $f_y(-2, -3)$.

$$f_{(x,y)} = \frac{d}{dy} \left(\frac{8x^{4}y^{5} + 3x^{3} - 12y^{2}}{4y^{2}} \right)$$

$$= \frac{d}{dy} \left(\frac{8x^{4}y^{5} + 3x^{3} - 12y^{2}}{4y^{2}} \right)$$

$$= \frac{8x^{4}dy}{dy} \left(\frac{y^{5}}{y^{5}} + 3x^{3}\frac{1}{4y}(1) - \frac{d}{dy}(12y^{2}) \right)$$

$$= \frac{(8x^{4})(5y^{4}) + (3x^{3})(0) - 2^{4}y}{(-2y^{4})^{4} - 2^{4}y}$$

$$= \frac{40x^{4}y^{4} - 24y}{(-2y^{4})^{4} - 24y}$$

$$f_{y}(-2y^{4} - 3y^{4}) = \frac{51912}{51912}$$

52. Compute $f_x(6,5)$ when

$$f(x,y) = \frac{(6x - 6y)^2}{\sqrt{y^2 - 1}}$$

$$f_{\chi}(x_f y) = \frac{d}{d\chi} \left(\frac{(6x - 6y)^2}{\sqrt{y^2 - 1}} \right)$$

$$= \frac{1}{\sqrt{y^2 - 1}} \frac{d}{d\chi} \left((6x - 6y)^2 \right)$$

$$= \frac{1}{\sqrt{y^2 - 1}} \cdot 2(6x - 6y) \frac{d}{d\chi} \left(6x + 6y \right)$$

$$= \frac{1}{\sqrt{y^2 - 1}} \cdot 2(6x - 6y) \cdot 6$$

$$= \frac{72x - 72y}{\sqrt{y^2 - 1}} f_{x}(6, 5) = \frac{72\sqrt{y^2 - 1}}{\sqrt{y^2 - 1}}$$

53. Find the first order partial derivatives of

$$f(x,y) = 3x^{2} \cdot \frac{y^{3}}{(y-1)^{2}} \qquad f(x,y) = \frac{3x^{2}y^{3}}{(y-1)^{2}}$$

$$f_{x}(x,y) = \frac{d}{dx} \left(3x^{2} \cdot \frac{y^{3}}{(y-1)^{2}} \right) = \frac{y^{3}}{(y-1)^{2}} \cdot \frac{d}{dx} \left(3x^{2} \right) = \frac{y^{3}}{(y-1)^{2}} \cdot 6x$$

$$f_{y}(x,y) = \frac{d}{dy} \left(3x^{2} \cdot \frac{y^{3}}{(y-1)^{2}} \right) = 3x^{2} \frac{d}{dy} \left(\frac{y^{3}}{(y-1)^{2}} \right) = 3x^{2} \left(\frac{3y^{2}(y-1)^{2} - y^{3} \cdot 2(y-1)}{(y-1)^{4}} \right)$$

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

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

$$f_{x}(x,y) = \frac{6xy^{3}/(y-1)^{2}}{(y-1)^{3}}$$

54. Find the first order partial derivatives of

$$f_{X}(x,y) = \frac{d}{dx} (X \operatorname{sin}(xy)) = \frac{d}{dx} (X) \operatorname{sin}(xy) + X \frac{d}{dx} (\operatorname{sin}(xy))$$

$$= \operatorname{sin}(xy) + X \operatorname{cos}(xy) \frac{d}{dx} (xy)$$

$$= \operatorname{sin}(xy) + X \operatorname{y} \operatorname{cos}(xy)$$

$$f_{Y}(x,y) = \frac{d}{dy} (X \operatorname{sin}(xy)) = X \frac{d}{dy} (\operatorname{sin}(xy))$$

$$= X \operatorname{cos}(xy) \frac{d}{dy} (xy)$$

$$f_{x}(x,y) = \frac{\operatorname{sin}(xy) + X \operatorname{y} \operatorname{cos}(xy)}{f_{x}(x,y)}$$

$$= X \operatorname{cos}(xy) \frac{d}{dy} (xy)$$

$$f_{y}(x,y) = \frac{\operatorname{sin}(xy) + X \operatorname{y} \operatorname{cos}(xy)}{f_{y}(x,y)}$$

55. Find the first order partial derivatives of $f(x,y) = (xy - 1)^2$

$$f_{x}(x,y) = \frac{d}{dx}((xy-1)^{2}) = 2(xy-1)\frac{d}{dx}(xy-1)$$
$$= 2(xy-1)y$$
$$= 2xy^{2} - 2y$$

$$f_{y}(x,y) = \frac{d}{dy}((xy-1)^{2}) = 2(xy-1)\frac{d}{dy}(xy-1)$$

$$= 2(xy-1) \times$$

$$= 2x^{2}y - 2x$$

$$f_{x}(x,y) =$$

$$2x^{2}y - 2x$$

$$f_{y}(x,y) =$$

56. Find the first order partial derivatives of $f(x, y) = xe^{x^2 + xy + y^2}$

$$f_{X}(x,y) = \int_{X} (x) e^{x^{2} + xy + y^{2}} + x \int_{X} (e^{x^{2} + xy + y^{2}})$$

$$= e^{x^{2} + xy + y^{2}} + x(e^{x^{2} + xy + y^{2}})(2x + y)$$

$$= (1 + 2x^{2} + xy)e^{x^{2} + xy + y^{2}}$$

$$f_{Y}(x,y) = x \int_{X} (e^{x^{2} + xy + y^{2}}) = x(e^{x^{2} + xy + y^{2}})(x + 2y)$$

$$= (x^{2} + 2xy)e^{x^{2} + xy + y^{2}}$$

$$f_{x}(x,y) = \underbrace{(1 + 2x^{2} + xy)e^{x^{2} + xy + y^{2}}}_{f_{y}(x,y) = \underbrace{(1 + 2x^{2} + xy)e^{x^{2} + xy + y^{2}}}_{(x^{2} + 2xy)e^{x^{2} + xy + y^{2}}}$$

57. Find the first-order partial derivatives of
$$f(x, y) = -7 \tan(x^7 y^8)$$

 $f_X(x_1 y) = -7 \frac{1}{4x} (+ \pi n(x^7 y^8)) = -7 \sec^2(x^7 y^8) \frac{1}{4x}(x^7 y^8)$
 $= -7 \cdot 7 \times 6 \frac{9}{y^8} \sec^2(x^7 y^8) = -49 \times 6 \frac{9}{y^8} \sec^2(x^7 y^8)$
 $f_Y(x_1 y) = -7 \frac{1}{4y} (+ \pi n(x^7 y^8)) = -7 \sec^2(x^7 y^8) \frac{1}{4y}(x^7 y^8)$
 $= -7 \cdot 8 x^7 y^7 \sec^2(x^7 y^8)$
 $= -56 x^7 y^7 \sec^2(x^7 y^8)$
 $f_y(x, y) = \frac{-49 \times 6 \frac{9}{y^8} \sec^2(x^7 y^8)}{f_y(x, y)} = \frac{-49 \times 6 \frac{9}{y^8} \sec^2(x^7 y^8)}{-56 \times 7 y^7 \sec^2(x^7 y^8)}$
58. Find the first order partial derivatives of $f(x, y) = y \cos(x^2 y)$
 $f_X(x_1 y) = y \frac{1}{4x} (\cos(x^2 y)) = y (-\sin(x^2 y)) \frac{1}{4x} (x^2 y) = -y \sin(x^2 y) [2xy]$
 $= -2 \times y^2 \sin(x^2 y)$

$$f_{x}(x,y) = \int_{x} (\cos(x^{2}y)) dx(x^{2}y) dx(x^{2}y)$$

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