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Mechatronics Engineering
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MAT 102

1 Find the derivative of the following using first Principle

a) $y = \sin(3/x^2)$

$$d/dx\left[\sin(3/x^2)\right] = \cos(3/x^2)\cdot 3\cdot d/dx\left[1/x^2\right] = 3\cos(3/x^2)(-2)x^{-3}$$

$$= \frac{-6\cos(3/x^2)}{x^3}$$

b) $y = 4/x^3 = 4(-3)x^{-4} = -12/x^4$

2) Find the integral of the following

a) $dx/(x^2+36)$

soln

$$\int 6/36u^2+36\, du = 1/6\int \frac{1}{u^2+1}\, du = \frac{\arctan(u)}{6} = \frac{\arctan(x/6)}{6}$$

$$= \frac{\arctan(x/6)}{6} + c$$

b) $dx/(x^2+13)$

soln

$$\int \frac{\sqrt{13}}{13u^2+13}\, du = \frac{1}{\sqrt{13}}\int \frac{1}{u^2+1}\, du = \int \frac{1}{u^2+1}\, du$$

$$\frac{1}{\sqrt{13}}\int \frac{1}{u^2+1}\, du = \frac{\arctan(u)}{\sqrt{13}} = \frac{\arctan(x/\sqrt{13})}{\sqrt{13}} + c$$