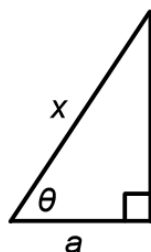


- 1) Given that

$$\int \sec \theta \tan^2 \theta \, d\theta = \frac{1}{2} \sec \theta \tan \theta - \frac{1}{2} \ln |\sec \theta + \tan \theta| + k$$

use the triangle



to construct a trigonometric substitution and evaluate the integral

$$\int \sqrt{x^2 - a^2} \, dx.$$

- 2) Calculate
- $\frac{d^{71} \cos x}{dx^{71}}$
- .

- 3) Evaluate

$$\int x^2 \cosh x \, dx = \int f'(x) \, dx = f(x) + k$$

by assuming a function of the form

$$f(x) = Ax^2 \cosh x + Bx^2 \sinh x + Cx \cosh x + Dx \sinh x + E \cosh x + F \sinh x,$$

differentiating it, and then by choosing the values of the constants  $A, B, C, D, E$  and  $F$  appropriately.

- 4) In 2014, the population of Houston, TX was 2.168 million people. In 2020 it was 2.313 million. Estimate the population of Houston in 2032.

- 5) Solve

$$\frac{dy}{dx} = 50 - 3y$$

for  $y = y(x)$  subject to the initial condition  $y(0) = 25$ .

- 6) A cup of tea was taken out of a microwave and put on the kitchen counter. The temperature of the kitchen was 72°F. After four minutes, the temperature of the tea was 120°F. After another four minutes its temperature was 95°F. What was the temperature of the tea when it was taken out of the microwave?

- 7)

$$\lim_{x \rightarrow 0^+} \frac{\cos x - 1}{x^3} = ?$$

- 8)

$$\lim_{x \rightarrow 0} \frac{\sin 6x}{\tan 3x} = ?$$

- 9)

$$\lim_{x \rightarrow 0^+} (8x)^{2x} = ?$$