

The following list of problems cover basic material from Pre-Calculus, Trigonometry, Calculus I and II of which you are expected to have a working knowledge. Please do them all and review material that you feel that you are weak on. If you had to struggle with many of these questions, I would suggest retaking a lower level class in order to fill in the gaps.

1.) Differentiate the following functions:

$$g(x) = xe^{-kx^2}, k \text{ is a constant}$$

$$g(x) = \int_0^x \tan^{-1}(e^s) ds$$

$$g(y) = \sqrt{y^3 + 1}. \text{ Express your answer using radical notation.}$$

$$g(t) = (t - \pi) \sin(2\pi(t - 10))$$

2.) Evaluate the following limits:

$$\lim_{x \rightarrow \infty} \frac{e^{2x} - 3e^{3x}}{-4e^{2x} + e^{3x}}$$

$$\lim_{x \rightarrow -\infty} \frac{e^{2x} - 3e^{3x}}{-4e^{2x} + e^{3x}}$$

$$\lim_{x \rightarrow 0^+} x \ln x$$

$$\lim_{x \rightarrow 0} \frac{x}{e^{-x}}$$

$$\lim_{x \rightarrow \frac{\pi}{2}^+} \tan x$$

$$\lim_{x \rightarrow \infty} \frac{\cos x}{x}$$

3.) Evaluate the following integrals.

$$\int \frac{x+2}{(x-1)(x+3)} dx$$

$$\int \tan^{-1} x dx$$

$$\int \sin^2 2s ds$$

$$\int x\sqrt{3x^2+1} dx$$

4.) Algebra Problems and Trigonometry

Solve for x : $e^{2x} + 5e^x - 5 = 1$

Solve for x : $\ln x + \ln(x + 1) = \ln 6$

Express $y = 2x^2 + 6x + 1$ in the form $y = a(x - h)^2 + k$

Write $\sqrt{(\sqrt{x})^3}$ in exponential form.

Solve the system of equations:

$$2x + 3y = 1$$

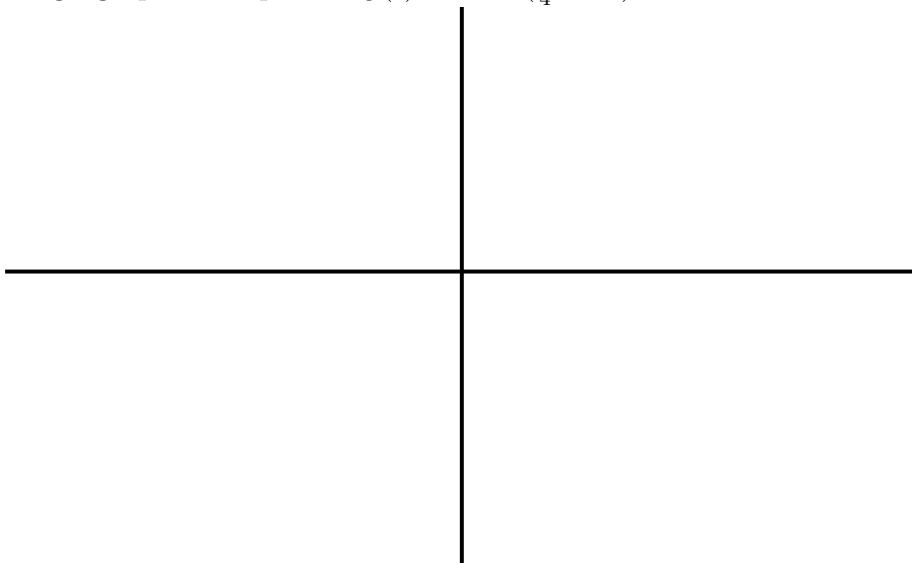
$$-x - \frac{3}{2}y = 2$$

Find the value of $\tan(\sin^{-1} y)$

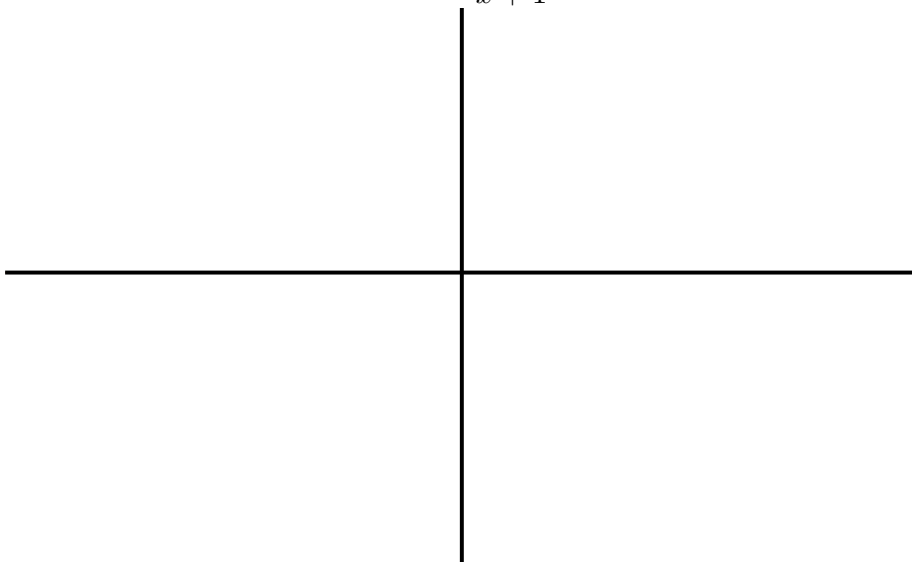
Use correct mathematical notation to describe what it means to say that a function $f(x)$ is differentiable at $x = a$.

Provide an example of a function that is not differentiable at $x = 1$.

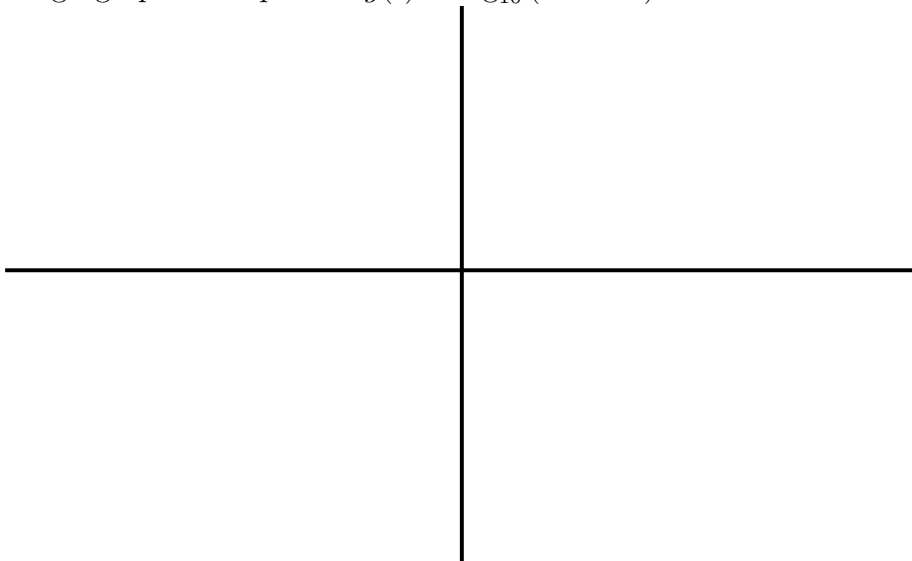
Provide a rough graph the equation $g(t) = 4 \sin \left(\frac{\pi}{4} - 2t \right)$. Neatness counts!



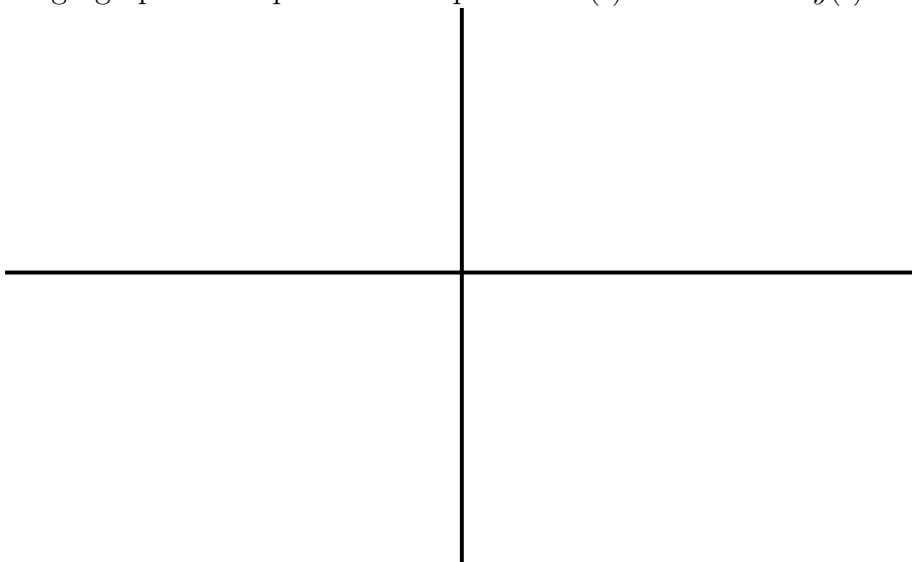
Provide a rough graph the equation $g(t) = \frac{3x^2 + 2}{x + 1}$. Neatness counts!



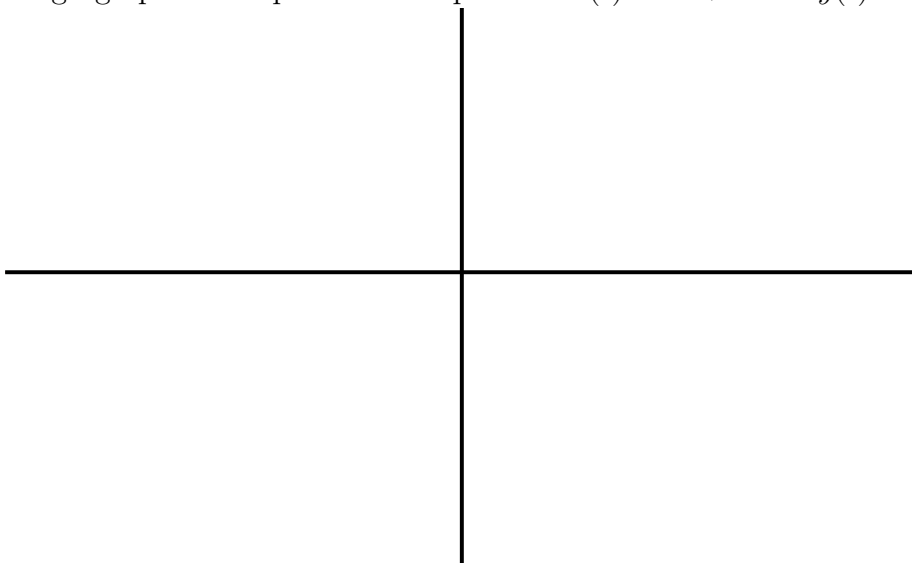
Provide a rough graph the equation $g(t) = \log_{10} (100 - x)$. Neatness counts!



Provide a rough graph of the parametric equations $x(t) = 2 \sin t$ and $y(t) = 2 \cos t$. Neatness counts!



Provide a rough graph of the parametric equations $x(t) = 3t + 1$ and $y(t) = -t + 2$. Neatness counts!



5.) Evaluate the following improper integrals.

$$\int_0^{\infty} e^{-x} dx$$

$$\int_0^1 \frac{1}{\sqrt{x}} dx$$

$$\int_1^{\infty} \frac{1}{\sqrt{x}} dx$$