

# Math 1A Final Review problems

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1. Compute the limits of the following:

(a)  $\lim_{x \rightarrow 0} \frac{\sin 3x}{x}$

(b)  $\lim_{x \rightarrow \infty} \frac{\sin x}{x}$

(c)  $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x}$

(d)  $\lim_{x \rightarrow 0} \frac{\int_0^{x^2} e^{t^2} dt}{x^2}$

2. Using  $\epsilon - \delta$ , prove:  $\lim_{x \rightarrow 2} (x + 1)(x + 2) = 12$

3. Sketch the curve of the equation:  $f(x) = \frac{x^3}{x^2 + 1}$

4. There is a spool of wire 100 cm long. At what point should I cut the wire, and use the two segments to make two shapes, a square and a circle, such that the sum of their areas is maximized?
5. The radius of a sphere is measured at 10 cm, with 1% error. What is the maximum error in the calculated volume?
6. An equilateral triangular trough with sides 8 cm and length 12 cm is leaking water at the rate of 0.5 cubic centimeters per second. When the water level is 4 cm high, how fast is the water level decreasing?

7. Integrate:

(a)  $\int x e^{-x^2} dx$

(b)  $\int_2^4 \sqrt{4 - (x - 2)^2} dx$

(c)  $\int \frac{x}{x - 1} dx$