1. We were supposed to compute $\int_{0}^{1} x^2 \, dx$ using a Riemann sum but I can’t do it!

   (a) Can’t we just integrate and get $\frac{x^3}{3}$?
   (b) Why do we need to do this when the integral is so easy? Aren’t there better ways to do this?
   (c) What if the integral was $\int_{1}^{3} x^3 \, dx$?

2. I can see where to use the first fundamental theorem of calculus but I don’t see why we care about the second ftc. And besides, why do they integrate with respect to $t$.

   Version 1: $\int_{a}^{b} F'(x) \, dx = F(b) - F(a)$

   Version 2: $\frac{d}{dx} \int_{a}^{x} f(t) \, dt = f(x)$

   (a) Just doesn’t make sense, why is there a $t$ in the integral?
   (b) How can you take the derivative of an integral?
   (c) Doesn’t the derivative and integral just cancel out? Why is there $F(b) - F(a)$, should it just be $F(x)$?

3. I don’t get these limits:

   $\lim_{x \to 0} \frac{\sin 5x}{x} \quad \lim_{x \to 0} \frac{\sin 3x}{\tan x}$

   (a) Can’t we just cancel the $x$’s?
   (b) If $\frac{\sin x}{x} = 1$ then why isn’t the first one just 1?
   (c) What about $(\cos x)/x$?
4. I don’t understand how to find the sum
\[ \sum_{k=1}^{\infty} \frac{2^k}{3^k} \]
(a) What if the sum was actually
\[ \sum_{k=4}^{\infty} \frac{2^k}{3^k} \]
(b) What if the sum was actually
\[ \sum_{k=4}^{\infty} \frac{2^{k+3}}{3^k} \]

5. I don’t understand how to find the maximum and minimum of
\[ y = 2x^3 + 9x^2 - 60x + 7 \]
(a) What if \( y = 2x^3 + 6x^2 - 60x + 7 \)

6. Find
\[ \int \frac{6}{6 + e^x} \, dx \]

7. Find the area between \( y = 3 \sin x \) and \( y = 3 \cos x \) over the interval \( [0, \pi] \).

8. There is a line through the origin that divides the region bounded by the parabola \( y = x - 3x^2 \) and the \( x \)-axis into two regions with equal area. What is the slope of that line?