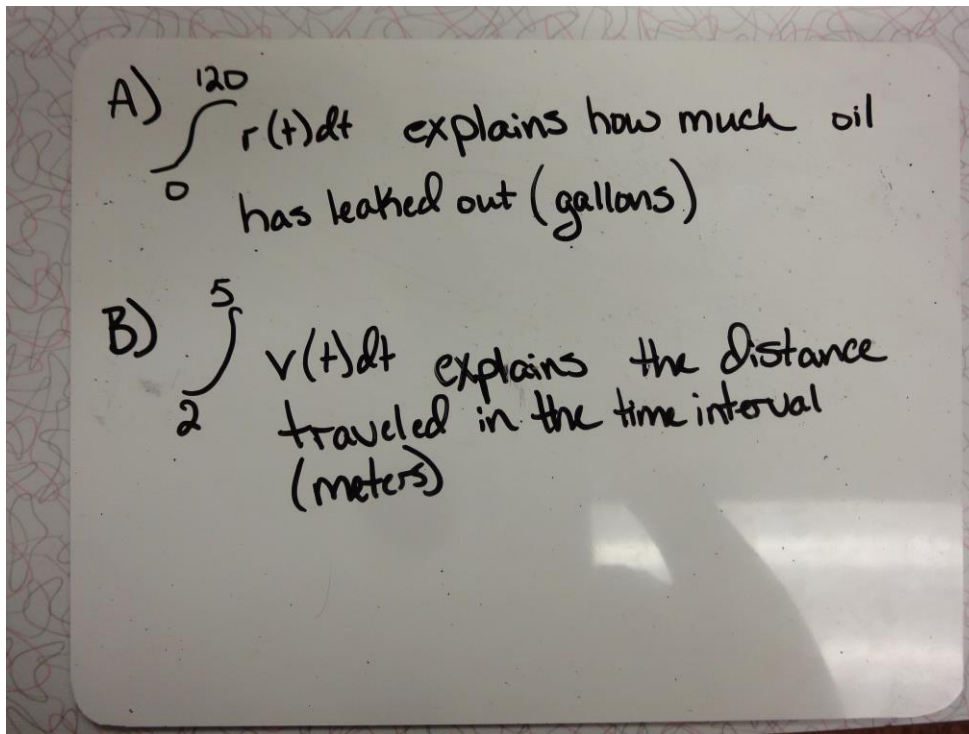


One solution to  $\int \frac{1}{1-\cos x} dx$  (using the conjugate idea):

$$\begin{aligned}\int \frac{1}{1-\cos x} dx &= \int \frac{1}{1-\cos x} \cdot \frac{1+\cos x}{1+\cos x} dx \\ &= \int \frac{1+\cos x}{1-\cos^2 x} dx \\ &= \int \frac{1+\cos x}{\sin^2 x} dx \\ &= \int \left( \frac{1}{\sin^2 x} + \frac{\cos x}{\sin^2 x} \right) dx \\ &= \int \left( \frac{1}{\sin^2 x} + \frac{1}{\sin x} \cdot \frac{\cos x}{\sin x} \right) dx \\ &= \int (\csc^2 x + \csc x \cot x) dx \\ &= \boxed{-\cot x - \csc x + C}\end{aligned}$$

Solutions to interpreting the meaning of an integral:



a total volume leaked  
out in 2 hrs

gallons

b distance traveled between  
2 and 5 seconds

meters

a)  $\int_0^{120} r(t) dt$  is how many gallons  
of oil is leaked after  
120 minutes.

b)  $\int_2^5 v(t) dt$  is how many  
meters the object has  
moved between 2 and 5  
seconds.

As was mentioned in class for part (b),  $\int_2^5 v(t) dt = \int_2^5 s'(t) dt = s(5) - s(2)$ . Thus, the integral doesn't necessarily represent the distance traveled (unless the object moves in the same direction from  $t = 2$  to  $t = 5$ ). Since the object may turn around and travel in the opposite direction, a more accurate description of  $\int_2^5 v(t) dt$  would be that it measures the **displacement** over this 3 second period.