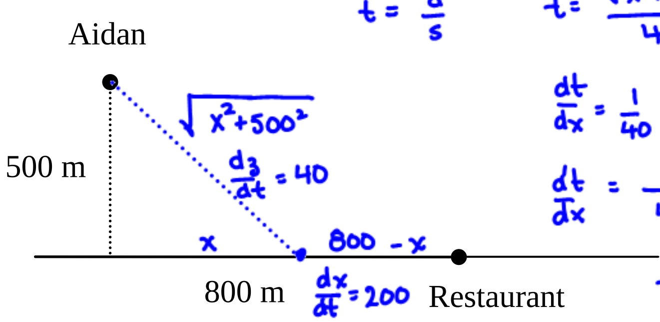
## *Warmup 5.2*

1. Aidan is in a canoe is 500 m away from shore. He can paddle at 40 m/min and jog at 200 m/min. He wants to reach a fish and chips restaurant on the shore that is 800 m away from the point directly opposite him on the shore. Aidan is very hungry, and wants to reach the restaurant as quickly as possible. (You don't want to see Aidan when he has been deprived of a meal) At what point on the shore should he land his canoe?




$t = \frac{d}{s}$

$t = \frac{\sqrt{x^2+500^2}}{40} + \frac{800-x}{200}$

$\frac{dt}{dx} = \frac{1}{40}\left(\frac{1}{2}\right)(x^2+500^2)^{-\frac{1}{2}}(2x) + \frac{-1}{200}$

$\frac{dt}{dx} = \frac{x}{40\sqrt{x^2+500^2}} - \frac{1}{200}$

$\frac{1}{200} = \frac{x}{40\sqrt{x^2+500^2}}$

$200x = 40\sqrt{x^2+500^2}$

$40000x^2 = 1600x^2 + 400{,}000{,}000$

$38400x^2 = 400\ 000\ 000$

$x = 102.6$ m along shore.

2. Determine (An identity crisis is not a good thing to experience at this point)

a) $\int e^{15x}dx \quad = \quad \frac{1}{15}e^{15x} + C$

b) $\int\left(\frac{\sin 8x}{3} - x^{\frac{2}{3}}\right)dx \quad = \quad \frac{-\cos(8x)}{3}\left(\frac{1}{8}\right) - \frac{3}{5}x^{\frac{5}{3}} + C$

$= \frac{-\cos(8x)}{24} - \frac{3}{5}x^{\frac{5}{3}} + C$

c) $\int\left(\sin^2 x + \cos^2 x\right)dx$

$\int(1)\,dx \quad = \quad x + C$

$\frac{\cos^2}{\sin^2} = \frac{1 - \sin^2}{\sin^2\ \ \sin^2}$

d) $\int\left(\cos^2 x - \sin^2 x\right)dx$

$\int(\cos 2x)\,dx \quad = \quad \frac{1}{2}\sin 2x + C$

e) $\int \cot^2 x\,dx$

$\int(\csc^2 x - 1)\,dx \quad = \quad -\cot(x) - x + C$