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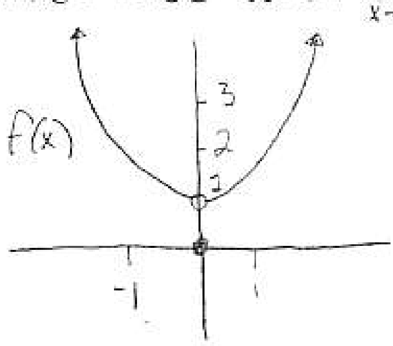
Math HW

Section 2.2

2) True or False: When $\lim_{x \to a} f(x)$ exists, it always equals $f(a)$



False. The limit as x approaches zero is 1 but $f(0) = 0$ in the example I created. Therefore $f(x) \neq f(a)$

Section 2.3

80) Space ship length L_0 is travelling at speed v, where c = speed of light

$L = L_0\sqrt{1-\frac{v^2}{c^2}}$

(80a) What is length of ship if its travelling 50% of c?

$L = L_0\sqrt{1-\frac{\left(\frac{c}{2}\right)^2}{c^2}}$ - we substitute $\frac{1}{2}c$ into the place of 'v' because c is a constant and v = one half of c $\therefore$ $v = \frac{c}{2}$

$L = L_0\sqrt{1-\frac{\left(\frac{c^2}{4}\right)}{c^2}}$

$L = L_0\sqrt{1-\frac{c^2}{4c^2}}$ - then we simplify the equation

$L = L_0\sqrt{1-\frac{1}{4}}$ - the 'c^2' cancel out leaving $L = L_0\sqrt{1-\frac{1}{4}}$

$L = L_0\sqrt{\frac{3}{4}}$

$L = L_0\frac{\sqrt{3}}{2}$ - to remove the radical from the denominator we find $\sqrt{4}$ which is 2

What is length L of ship if its travelling 75% of c?

80b) $L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$

$L = L_0 \sqrt{1 - \frac{\left(\frac{3c}{4}\right)^2}{c^2}}$ - we substitute in $\frac{3}{4}c$ into the place of v because c is a constant and we are trying to find v in terms of c where v = 75% of c which is $v = \frac{3c}{4}$

$L = L_0 \sqrt{1 - \frac{\frac{9c^2}{16}}{c^2}}$

$L = L_0 \sqrt{1 - \frac{9c^2}{16c^2}}$ - then we simplify the equation

$L = L_0 \sqrt{1 - \frac{9}{16}}$ - the 'c^2' cancel out

$L = L_0 \sqrt{\frac{16}{16} - \frac{9}{16}}$

$L = L_0 \sqrt{\frac{7}{16}}$

$L = L_0 \frac{\sqrt{7}}{4}$ - we remove the radical in the denominator by finding $\sqrt{16}$ which is 4

What happens to L as speed of light increases?

20c) L becomes smaller because as v approaches c, L approaches zero because at 100% v = c which forms $\frac{c^2}{c^2}$ which equals 1 and in the formula $L = L_0\sqrt{1-1}$ which would make 'L' equal to zero

80d) Find $\lim_{v \to c^-} L_0 \sqrt{1 - \frac{v^2}{c^2}}$ and explain significance of limit.

As v approaches c L approaches zero. If v was equal to c then we would have $\frac{c^2}{c^2}$ in the formula which would equal 1. When 1 is substituted into the formula $L = L_0\sqrt{1-1}$ which makes L = zero. At 50% $v = \frac{c}{2}$ but at 100% v = c which makes $\frac{c^2}{c^2}$ which equals 1