

Name: \_\_\_\_\_

1. Find the limit.

$$\lim_{x \rightarrow 0} \frac{\sin^{-1} x}{x}$$

type  $\frac{0}{0}$

$$\stackrel{\text{L'H}}{=} \lim_{x \rightarrow 0} \frac{\left(\frac{1}{\sqrt{1-x^2}}\right)}{1} = \boxed{1}$$

2. 11 tribbles are released on the Starship Enterprise. Tribbles reproduce at a rate proportional to their population. After 12 hours there are 121 tribbles aboard the Enterprise.

- (a) Find an expression for the number of tribbles after
- $t$
- hours.

$$P(t) = P(0)e^{kt} = \boxed{11e^{kt}}$$

$$P(12) = 121 = 11e^{k \cdot 12}$$

$$e^{k \cdot 12} = \frac{121}{11}$$

$$e^{k \cdot 12} = 11$$

$$k \cdot 12 = \ln 11$$

$$\boxed{k = \frac{\ln 11}{12}}$$

- (b) How many tribbles will there be after 18 hours?

$$P(18) = \boxed{11e^{k \cdot 18} \text{ tribbles}}$$

- (c) When will the population reach 1,770,000 tribbles?

$$11e^{kt} = 1,770,000$$

$$e^{kt} = \frac{1,770,000}{11}$$

$$k \cdot t = \ln \left( \frac{1,770,000}{11} \right)$$

$$\boxed{t = \frac{\ln \left( \frac{1,770,000}{11} \right)}{k} \text{ hours}}$$