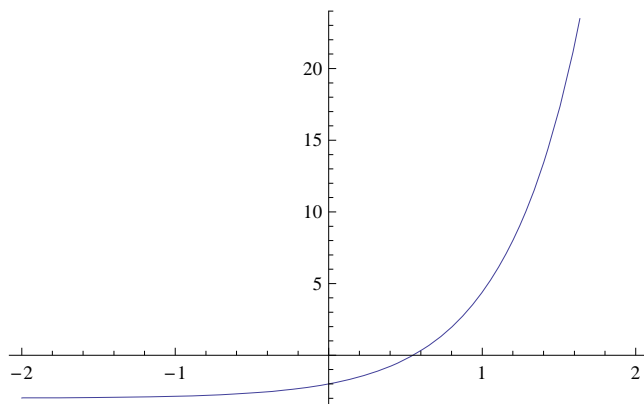


NTSC 395

PRACTICE PROBLEM SOLUTIONS

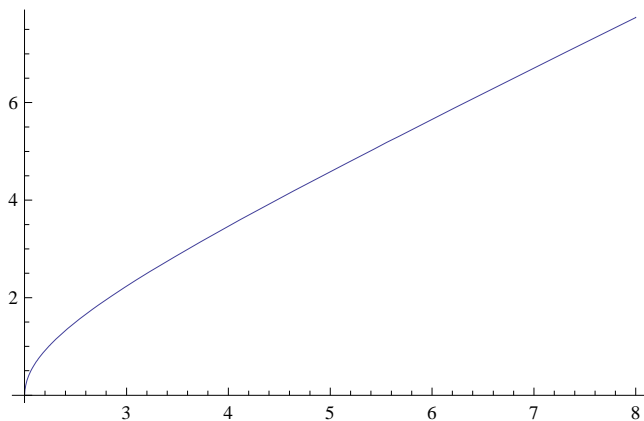
In[548]:= **Plot[Exp[2 x] - 3, {x, -2, 2}]**

Out[548]=



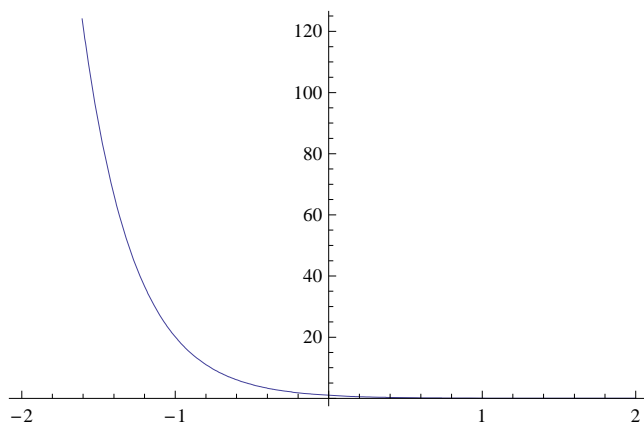
In[549]:= **Plot[Sqrt[x^2 - 4], {x, 2, 8}]**

Out[549]=



In[550]:= **Plot[Exp[-3 x], {x, -2, 2}]**

Out[550]=



II.

$$\begin{aligned} \text{A) dist} &= \frac{1}{2} a t^2 \\ \text{dist} &= \frac{1}{2} (3 \text{ m/s/s}) (7 \text{ s})^2 = 73.5 \text{ m} \\ \text{B) dist} &= v_0 t + \frac{1}{2} a t^2 = (10 \text{ m/s}) (7 \text{ s}) + \frac{1}{2} a t^2 = \\ &(10 \text{ m/s}) (7 \text{ s}) + 73.5 \text{ m} = 143.5 \text{ m} \\ \text{C) dist} &= \frac{1}{2} a t^2 = \frac{1}{2} (9.8 \text{ m/s/s}) (7 \text{ s})^2 = 240.1 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{D) avg speed} &= \frac{\text{dist}}{\text{time}} = \frac{2 \pi r}{1 \text{ year}} = \frac{2 \pi (1.5 \times 10^{11} \text{ m})}{365.25 \text{ days} \times 24 \text{ hr/day} \times 60 \text{ min/hr} \times 60 \text{ sec/min}} = \\ &\frac{9.42 \times 10^{11} \text{ m}}{3.156 \times 10^7 \text{ s}} = 29850 \text{ m/s} \end{aligned}$$

III.

$$\frac{1}{o} + \frac{1}{i} = \frac{1}{f}$$

If $o = f$, then :

$$\frac{1}{f} + \frac{1}{i} = \frac{1}{f} \Rightarrow \frac{1}{i} = 0 \Rightarrow i = \infty$$

If $f = 20 \text{ cm}$ and $o = 40 \text{ cm}$:

$$\begin{aligned} \frac{1}{i} &= \frac{1}{20} - \frac{1}{40} = \frac{1}{40} \Rightarrow i = 40 \text{ cm} \\ m &= \frac{-i}{o} = -\frac{40 \text{ cm}}{40 \text{ cm}} = -1 \end{aligned}$$

The image is as large as the object, but is inverted.

VI.

The net rate of increase with respect to 2010 constant dollars is 8 %, so the "real" increase in value is :

$$M(t) = M_0 (1.08)^{10} = 1000 (1.08)^{10} = 2158.93$$

In the absence of inflation, the value of the investment after ten years would be :

$$M(10) = 1000(1.10)^{10} = 2593.74$$

The activity you did with potato cooling rates showed you that the cooling rate was greatest when the temperature difference between the potato and environment was greatest. Therefore, the hot liquid will cool the fastest when the temperature between the liquid and air is greatest; this means that you should let the untopped liquid cool before putting on the whipped cream.

VII.

Larger animals have a larger volume to area ratio, and therefore retain heat longer. Since Mars is a very cold environment, the Viking Life Scientists assumed life on Mars, if it existed, would parallel that of the Earth's polar regions.