$\log_7 \sqrt[5]{49}$ $\frac{2}{5}$

$\log_{\frac{1}{2}} 32 = -5$

$\log_{\sqrt[3]{25}} \frac{1}{5} = x = -\frac{3}{2}$

$\log_2 |x| = 3$ $x = \pm 8$

$\log_5 (x+4) + \log_5 x = \log_5 5$ $x = 1, -5$

$\log_8 x + \log_8 (x-2) = 1$ $x = -2, 4$

$\frac{1}{2} \log_2 x + 3 = \log_2 16^{\frac{5}{4}}$ $x = 16$

$x=\frac{1}{3}$

① $2(3)^{3x+1} = 18$

$x=15$ ② $\log_{\sqrt[3]{2}} 32 = x \rightarrow \sqrt[3]{2}^{x} = 32$

$2^{\frac{x}{3}} = 2^{5}$

$\frac{x}{3} = 5 \cdot 3$

$x = 15$

③ $\log_{\frac{1}{16}} x = -\frac{3}{2}$ (64)

④ $\log_{\sqrt{x}} 125 = 3 \;/\; x=25$

⑤ $\frac{3}{2} \cdot \frac{2}{3} \ln(x-5) = 4 \cdot \frac{3}{2}$ $\quad x = e^{6}+5$

$\ln(x-5) = 6$ $\quad e^{6} = x-5$

⑥ $\log(x+4) - \log 45 = -\log x$ $\quad x=5, -9$

⑦ $\log_2(x+3) - 1 = \log_2 x$ $\quad x=3$

⑧ $\ln 2x = 2 - 2\ln 3$ $\quad x=\frac{e^2}{18}$

⑨ $4^{2\log_4 5 - \log_4 5} = 5$

⑩ $16^{\log_4 7} = 49$

$A = Pe^{rt}$

Response to TV Advertising

1. The percent of R viewers who respond to a television commercial for a new product after t days is found by using the formula $R = 0.7 - e^{-0.2t}$

a) What percent is expected to respond after 10 days? $= t$

$R = 0.7 - e^{(-0.2(10))} = 0.565 \rightarrow \boxed{56.5\%}$

b) How many days until 40% of the viewers have responded?

$.4 = 0.7 - e^{-.2t}$ | $R = \frac{40}{100} = 0.4$

$-.7 \quad -.7$

$-.3 = -e^{-.2t} \rightarrow e^{-.2t} = .3 \rightarrow \ln_e 0.3 = -.2t$

$\frac{-1.204}{-.2} = \frac{-.2t}{-.2}$

$\boxed{6.02 \text{ days} = t}$

Optics

2. If a single pane of glass obliterates 10% of the light though it. If P is the percent of light that passes though and n is the number of successive panes of glass.

n $\qquad P = 0.5$

a) Find the number of panes of glass needed to successfully block 50% of the light given the equation below.

$P = e^{-0.1n}$

$.5 = e^{-0.1n}$

$\ln_e 0.5 = -0.1n$ | $\frac{-.693}{-0.1} = \frac{-0.1n}{-0.1}$

$\boxed{n = 6.93 \text{ panes}} \rightarrow 7 \text{ panes}$

$\rightarrow 50\%$ passes thru

b) What percent of the light is blocked by 4 panes of glass?

$P = e^{(-0.1(4))} = 0.67 \rightarrow 67\%$ passes through

$100 - 67 = \boxed{33\% \text{ blocked}}$

Population of an Endangered Species

3. Often environmentalists will capture an endangered species and transport the species to a controlled environment where the species can produce offspring and regenerate its population. Suppose 6 American Bald Eagles are captured and transported to Montana and set free. Based on experience, the environmentalists model.

$$P(t) = \frac{500}{1 + 83.33e^{-0.162t}}$$

a) What is the predicted population of the American Bald Eagle in 20 years? $= t$ $\quad P(20) = 117.27$ bald eagles

~~b)~~ When will the population be 300? 29.8 years

Doubling-Time Growth Formula: $N = N_0(2)^{\frac{t}{d}}$ — N = amt after time, t = time, d = doubling time, N_0 = initial amt.

6. There are initially 1,456 bacteria in a culture. If the number of bacteria doubles every 16 hours, how much will there be in 4 days? → $4 \times 24 = 96$ hours $= t$; $d = 16$

$N = 1456(2)^{96/16}$

$= 1456(2)^6 =$ **93,184 bacteria**

7. There are initially 1,234 bacteria in a culture. If the number of bacteria doubles every $2\frac{1}{4}$ hours, how long will it take the culture to grow to 12,345 bacteria? $d = 2.25$

$\frac{12345}{1234} = \frac{1234(2)^{t/2.25}}{1234}$

$10.004 = 2^{t/2.25}$

$\log_2 10.004 = \frac{t}{2.25}$

$2.25 \cdot 3.3225 = \frac{t}{2.25} \cdot 2.25$

$t = 7.48$ hours

Half-Life Decay formula: $N = N_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$ — h = half life; N_0

$h = 5760$

8. The half-life of carbon 14 is approximately 5760 years. Determine how much of 15mg of this substance will remain after 2500 years?

$t =$

$N = 15\left(\frac{1}{2}\right)^{\frac{2500}{5760}} = 15\left(\frac{1}{2}\right)^{0.434} =$ **11.1 mg**

9. One isotope of chromium has a half-life of 23 hours. How long does it take 50g to decay to 40g?

7.4 hrs.

10. After 24.0 days, 2.00 milligrams of an original 128.0 milligram sample remain. What is the half-life of the sample?

4 days