

10.2 Exponential Decay

1)

- a) $b > 1$
- b) $0 < b < 1$

3)

- a) $(0, 1)$
- b) $(0, 5)$
- c) $(0, 0.4)$
- d) $(0, \frac{1}{2})$

5) Summer 2001 students: Ignore this problem for now.

7) The half-life of an element is defined to be the amount of time it takes for half of the element to decay.

9)

- a) For equal time periods the output decreases by the same factor. The table shows that each 13 days the weight is halved.
- b) $y_0 = 1$ kg
- c) $b = \frac{1}{2}$
- d) The weight decreases by half every 13 days. $k = \frac{1}{13}$
- e) $y = y_0 b^{kx}$
 $y = (\frac{1}{2})^{\frac{t}{13}}$

11)

- a) $y_0 = 100$
- b) $b = \frac{20}{100} = \frac{4}{20} = \frac{1}{5}$
- c) $\frac{1}{k} = 2 \rightarrow k = \frac{1}{2}$
- d) $y = (100)(\frac{1}{5})^{\frac{t}{2}}$

13) Since $\frac{1}{4}$ of Thorium-234 decays in 10 days, $\frac{3}{4}$ of it remains after 10 days.

Thus $b = \frac{3}{4}$, $y_0 = 60$, $k = \frac{1}{10}$, and $A = (60)(\frac{3}{4})^{\frac{t}{10}}$.

15) Machinery initially worth \$15,000 ($y_0 = 15,000$) whose value depreciates 12% each year means that its value in any given year is $100\% - 12\% = 88\%$ of its value the previous year ($b = 0.88$). Thus, the value of the machinery, y , is given

by the equation $y = 15,000(0.88)^x$, where x is the age of the machine (in years).
When the initial value is halved, the equation becomes $7500 = 15,000(0.88)^x$

$Y_1 = 7500$, $Y_2 = 15,000(0.88)^x$ WINDOW: 0 X 9.8, 0 Y 16,000, Intersect
The machinery will be worth half of its initial value in approximately 5.4 years.

Skill and Review

17) $72 \div 7 = 10.3 \rightarrow$ Population will double in approximately 10.3 yrs.

19) $y = ax^2$

a) $\frac{5}{2} = a(1)^2$

$$a = \frac{5}{2}$$

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

b) $y(3) = \frac{5}{2}(3)^2 = \frac{5}{2}(9) = \frac{45}{2} = 22.5$

c) $67.6 = \frac{5}{2}x^2$

$$\left(\frac{2}{5}\right)(67.6) = x^2$$

$$27.04 = x^2$$

$$x = \pm 5.2$$