4-5 Solution Set

5. Exponential $y = 250.70(0.89975)^x$
7. Linear $y = 0.15x + 9.7$
9. Exponential $y = 5.988(0.8004)^x$

11. a. $e(t) = 0.1821t - 0.0093$
    b. Slope = $m = 0.1821$; This means that the inner most is increasing by 1821 dollars per year since 1970 for Exponential function: $e(t) = 1.1(1.0581)^t$ and $b = 1.058$ This means that the funeral cost has been increasing by 5.8 % every year since 1970.
    c. Linear: $c^{-1}(t) = \dfrac{t + 0.0093}{0.1821}$ or $c^{-1}(t) = 5.4915t + 0.0511$.
    Exponential: $c^{-1}(t) = \dfrac{\log(0.909t)}{\log(1.058)}$ or $c^{-1}(t) = 40.84\log(0.090t)$.
    d. For Linear: $c(8) = 1.4475$ in 1978, average adult funeral cost was 14,475 dollars. For Exponential: $C(8) = 1.727$, In 1978 the average adult funeral cost was 1727 dollars.
    e. For Linear $c^{-1}(8) = 43.9$, in 44 years after 1970 or in 2013 the average adult funeral cost will be 8000 dollars. For Exp $c^{-1}(8) = 35.2$ in 35 years after 1970 or 2005 the average adult funeral cost will be 8000 dollars.

13. Account Balance $B(t) = B_0\left(1 + \dfrac{R}{100}\right)^t$ where B_0 is the initial investment at time $t = 0$ years. If the initial investment doubles in time $T(R)$ then,

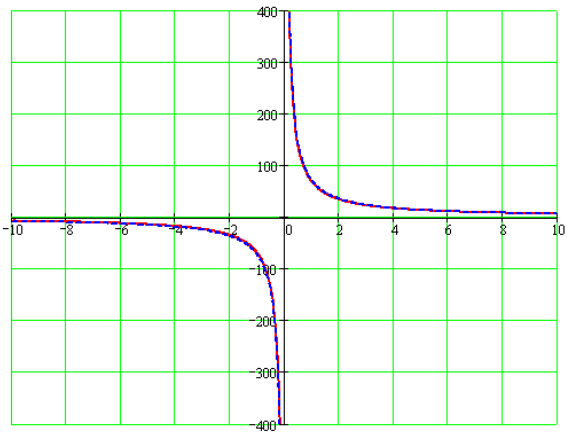
$$2B_0 = B_0\left(1 + \frac{R}{100}\right)^t$$

$$\Rightarrow \ln(2) = T\ln\left(1 + \frac{R}{100}\right)$$

$$\Rightarrow T(R) = \frac{\ln(2)}{\ln\left(1 + \dfrac{R}{100}\right)}$$

$T(R) = \dfrac{\ln(2)}{\ln\left(1+\dfrac{R}{100}\right)}$

$Y(r) = \dfrac{72}{r}$



The two graphs are almost identical within the typical values of R; Thus 'Rule of 72' is a quick way to estimate doubling time.

15. a. $l(t) = 16.496t - 540.85$.
    b. $l(25) = 16.494 \times 25 - 540 = -128.45$ dollars based on the linear model, the monthly Insurance rate for a 70 yr old male smoker is 613.87 dollars.
    c. $l^{-1}(500) = 63$:Is the monthly insurance rate of 500 dollars is that for a 63 year male smoker.
    d. $l(t) = 4.649(1.0785)^t$: $b = 1.0785$ This means that the monthly policy rates for make smokers increases by 7.85% for every one year increase in age.

17. a. Exponential function is a better fit as the increase is by a constant rate rather than a constant amount.
    b. $S(t) = 0.0833(2.649)^t$.
    c. $b = 2.649$ is the sales increase by 164.9% ever year since 1990. Between 1996 and 1997 the company experiences the greatest growth in sales.
    d. $1000 = 0.0833(2.649)^t$: $t = 9.64$ years since 1990. In 2000, the sales would have been 1 billion dollars.

19. a. $S(t) = -2.202t + 29.19$ where $t = 0$ in 1985.
    b. $S(t) = 81.52(0.7677)^t$ where $t = 0$ in 1085. Percentage rate of decay is 23.23%. Syphilis has been decreasing at the rate of 23.23% since 1985.
    c. $81.52(0.7677)^t = 1, t = 16.65$ (ie 17 years after 1985 or the year 2002).
    d. In 2004, $t = 19$: $S(19) = 0.54$ cases per 100,000 people (ie for a population, total number of cases is $\dfrac{0.54}{100,000} \cdot \left(275 \times 10^6\right)$ or 1485 cases).

21. Quadratic function $1.643x^2 + 10.49x - 4.1766 = 0$.

23. Exponential function $y = 0.2(1.2)^x$.

25. Linear function $y = -3x + 1000.4$.

27. Quadratic Model for a power function: $y = 8.803x^2 - 235.73x + 1877.34$. The quadratic model shows that the number of primes increases for large integers. An exponential function is a better fit $y = 1558.1(0.8847)^x$ and as per intuition, the number of primes decreases for large integers.