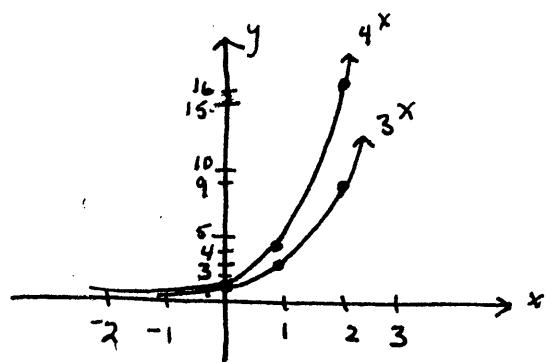


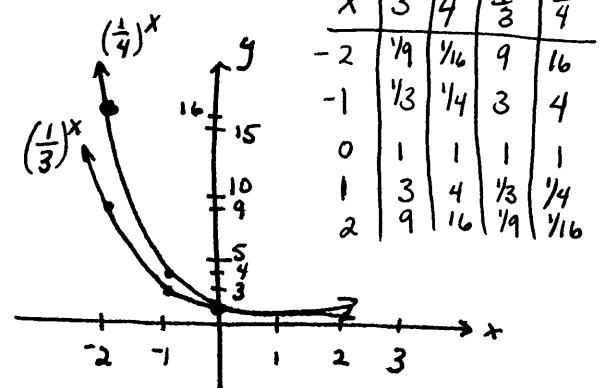
## Section 4.1 - Exponential Functions

$$\begin{array}{lll} 1. \quad e^2 \approx 7.389 & e^{-0.05} \approx 0.951 & \sqrt{e} \approx 1.649 \\ e^{-2} \approx 0.135 & e^0 = 1 & \frac{1}{\sqrt{e}} \approx 0.607 \\ e^{0.05} \approx 1.051 & e \approx 2.718 & \end{array}$$

3.



4.



6.

$$a) \left(\frac{1}{9}\right)^{3/2} = \left(\sqrt{\frac{1}{9}}\right)^3 = \left(\frac{1}{3}\right)^3 = \frac{1}{27}$$

$$b) \left(\frac{27}{64}\right)^{2/3} \left(\frac{64}{25}\right)^{3/2} = \left(\frac{3}{4}\right)^2 \left(\frac{8}{5}\right)^3 = \left(\frac{9}{16}\right) \left(\frac{512}{125}\right) = \frac{4608}{2000} = \frac{288}{125}$$

$$c) \left(\frac{27+36}{121}\right)^{3/2} = \left(\frac{63}{121}\right)^{3/2} = \frac{63^{3/2}}{11^3} \approx 0.376$$

$$d) (27^{2/3} + 8^{4/3})^{-3/2} = (3^2 + 2^4)^{-3/2} = (9+16)^{-3/2} = 25^{-3/2} = \frac{1}{5^3} = \frac{1}{125}$$

8.

$$(4^{2/3})(2^{2/3}) = (4 \cdot 2)^{2/3} = 8^{2/3} = (8^{1/3})^2 = 2^2 = 4$$

$$10. \left(\frac{\pi^2}{\sqrt{\pi}}\right)^{4/3} = (\pi^{2-1/2})^{4/3} = (\pi^{3/2})^{4/3} = \pi^2$$

$$12. [(e^2)(e^{3/2})]^{4/3} = [e^{2+3/2}]^{4/3} = (e^{7/2})^{4/3} = e^{14/3}$$

### Section 4.1-(cont)

14.  $P = 5000 \quad r = 0.1 \quad t = 10.$

- a) annually:  $k=1. \quad B = P(1 + \frac{r}{k})^{kt} = 5000(1 + 0.1)^{10} \approx \$12,968.71$
- b) semiannually:  $k=2. \quad B = 5000(1 + \frac{0.1}{2})^{20} \approx \$13,266.49$
- c) daily:  $k=365. \quad B = 5000(1 + \frac{0.1}{365})^{3650} \approx \$13,589.55$
- d) continuously:  $B = Pe^{rt} = 5000 e^{0.1(10)} = 5000 e^1 \approx \$13591.41$

17.  $B = 9000 \quad r = 0.07 \quad t = 5.$

- a) quarterly:  $k=4 \quad P = B(1 + \frac{r}{k})^{-kt} = 9000(1 + \frac{0.07}{4})^{-4 \cdot 5} \approx \$6361.42$
- b) continuously:  $P = B e^{-rt} = 9000 e^{-0.07(5)} \approx \$6342.19$

20.  $Q(t) = Q_0 e^{kt}$ .      Let 1986 be  $t=0$ ,  $Q = 60,000,000$ . ①  
 1991 is then  $t=5$ ,  $Q = 90,000,000$ . ②

Find  $Q$  in 2001 ( $t=15$ ).

$$\textcircled{1} \quad Q(0) = Q_0 e^{k(0)} = 60000000 \implies Q_0 = 60000000$$

$$\textcircled{2} \quad 90000000 = 60000000 e^{5k} \implies \frac{3}{2} = e^{5k} = (e^k)^5 \\ (3/2)^{1/5} = e^k$$

$$\textcircled{3} \quad Q = 60000000 e^{k \cdot 15} = 60000000 (\frac{3}{2})^{1/5 \cdot 15} \\ \approx 60000000 (\frac{3}{2})^3 = 60000000 (\frac{27}{8}) = 202500,000$$

26. 1626  $t=0 \quad Q = \$24$   
 1990  $t=364 \quad Q = \$25.2 \text{ billion}$

Invest  $P = 24$  at 7% annually, comp cont  
 for 364 years:

$$B = 24 (e^{0.07})^{364}$$

$$B \approx \$2,792,766,592,000$$

close to 3 trillion dollars!

Investment at 7% is a better deal by \\$2,767,566,592,000  
 (approx)

### Section 4.1-(cont)

33.  $Q(t) = Q_0 e^{-kt}$       ①       $500 = Q_0 e^0, \text{ so } Q_0 = 500.$   
 $t=0 \quad Q = 500g.$       ②       $400 = 500(e^{-k})^{50}$   
 $t=50 \quad Q = 400g.$       ③       $(.8)^{150} = e^{-k}$ .  
 $t=200 \quad Q = ?$       ④      ③       $Q = 500(e^{-k})^{200} = 500 (.8)^{150}$   
 $\qquad\qquad\qquad = 500 (.8)^4 = 500 (.4096) = 204.8g.$

43.  $A = \text{loan amt. } M = \text{monthly pmt}, n = \# \text{years}, i = \frac{r}{12} = \text{monthly int. rate.}$

$$M = \frac{Ai}{1 - (1+i)^{-12n}}$$

$A = 150000, r = 0.09, n = 30.$

Payment is  $M = \frac{150000 \left( \frac{0.09}{12} \right)}{1 - (1 + \frac{0.09}{12})^{-12(30)}} = \frac{150000 (0.0075)}{1 - (1.0075)^{-360}}$

$$M \approx \frac{1125}{1 - 0.067886} \approx \$1206.93.$$

44.  $M = 1200, n = 30, r = 0.08. \text{ Find } A.$

$$A = \frac{m \left( 1 - (1+i)^{-12n} \right)}{i} = \frac{1200 \left( 1 - (1 + \frac{0.08}{12})^{-360} \right)}{0.08/12}$$

$$\approx \frac{1200 (1 - 0.091443372)}{0.006666667} \approx \$163,540.21$$