Exponential Models WKST

I. Interest

1. Jackie makes an $800 deposit into a bank account earning 4.5% interest.
   a. If the interest is compounded quarterly how much money will Jackie have in 10 years?
   b. If the interest is compounded continuously how much money will Jackie have in 10 years?
   c. If Jackie's money is compounded continuously, how long will it take her money to double?
   d. If Jackie's money is compounded monthly, how long will it take her money to triple?

2. Joe deposits $3500 into a bank account that earns interest compounded continuously. If Joe's money doubles in 9 years, what interest rate was used?

3. Your generous family gives you a total of $3500 as gifts when you graduate from high school. You decide to invest this money in a savings account that earns interest at a rate of 3.7% per year. How much will you have in 4 years if your interest is compounded…
   a. Annually?
   b. Quarterly?
   c. Weekly?
   d. Continuously?

4. If you invest $10,000 at a 2.6% interest rate compounded continuously how long will it take for your investment to grow to $15,000? Round to 3 decimal places.

5. If your initial investment triples in 20 years what interest rate was used if your interest is compounded…
   a. Continuously?
   b. Monthly?

6. How much *interest* is earned in 30 years on an initial investment of $500 in an account that earns 3.4% interest compounded continuously?

7. Joe decides to invest $8000 for 25 years. Bank A compounds interest continuously at an annual rate of 3%. Bank B compounds interest quarterly at an annual interest rate of 4.5%. What bank should Joe pick?

8. If a savings account earns 4% interest compounded semiannually, how much money should be invested so that you have $25,000 at the end of 15 years?

9. Fill in the table for a savings account in which the interest is compounded continuously.

	Initial Investment	Annual % Rate	Time to Double	Amount After 10 Years
a)	$10,000	3.50%		
b)	$7,500		21 years	
c)	$5,000			$5,665.74

II. Other Models

10. At a local college campus of 7500 students, one student returns from vacation with a contagious and long-lasting virus. The spread of the virus is modeled by $y = \frac{7500}{1 + 7499e^{-0.9t}} \quad t \geq 0$, where y is the total number of students affected after t days. The college will cancel classes when 30% or more of the students are infected.
    a. How many students will be infected after 4 days?
    b. After how many days will the college cancel classes?

11. Movie tickets now average $9.75 a ticket, but are increasing 15% per year. How much will they cost 5 years from now?

12. A powerful computer is purchased for $2000, but on the average loses 20% of its value each year. How much will it be worth 4 years from now?

13. Dinner at your grandfather's favorite restaurant now costs $25.25 and has been increasing steadily at 4% per year. How much did it cost 35 years ago when he was courting your grandmother?

14. If a gallon of milk costs $3 now and the price is increasing 10% per year, how long before milk costs $10 a gallon?

15. The number of bacteria present in a colony is 180 at 12 noon and the bacteria grows at a rate of 22% per hour. How many will be present at 8 p.m.? Round to the nearest whole number.

16. A house purchased for $226,000 has lost 4% of its value each year for the past five years. What is it worth now?

17. A concert has been sold out for weeks, and as the date of the concert draws closer, the price of the ticket increases. The cost of a pair of tickets was $150 yesterday and is $162 today. Assuming that the cost continues to increase at this rate:
    a. What is the daily rate of increase?
    b. What will be the cost one week from now, the day before the concert?
    c. What was the cost two weeks ago?

18. You plant a sunflower seedling in your garden. The seedling's height *h* (in centimeters) after *t* weeks can be modeled by the logistic equation $h(t) = \frac{256}{1+13e^{-0.65t}}$. Find the time it takes the sunflower seedling to reach a height of 200 centimeters.

19. Most cars decrease in value after you leave the dealer. However, some cars are now considered "classics" and actually increase in value. You have the choice of owning two cars: A 2006 Mazda Miata which is worth $19,000 but is depreciating 10% per year, or a classic 1970 Ford Mustang which is worth $11,500 and is increasing in value by 6% each year.
    a. Write an equation to represent the value of each car over time.
    b. Using your graphing calculator, graph both functions simultaneously.
    c. Use your graphing calcualtor to determine approximately when the Mazda and the Ford have the same value. (Find the intersection using the intersection tool…)

III. Review (NO CALCULATOR)

20. Solve. State the exact answer.
    a. $\log 3x - 8 = -6$
    b. $\ln(3x+9) = \ln(-5x+1)$
    c. $\ln(3n-5) + \ln(n) = \ln(14+2n^2)$
    d. $2 - e^{2x+3} = -1$
    e. $4^{5-x} = 9^{3x+2}$

ANSWERS

I.

1.
   a. $1251.50
   b. $1254.65
   c. 15.403 years
   d. 24.459 years

2. 7.702%

3.
   a. $4047.46
   b. $4055.54
   c. $4058.08
   d. $4058.30

4. 15.595 years

5.
   a. 5.493%
   b. 5.506%

6. $886.60

7. Bank B

8. $13,801.77

9.

	Initial Investment	Annual % Rate	Time to Double	Amount After 10 Years
a)	$10,000	3.50%	19.804 years	$14,190.68
b)	$7,500	3.301%	21 years	$10,432.99
c)	$5,000	1.250%	55.452 years	$5,665.74

II.

10.
   a. 36.425 students
   b. 6.413 days

11. $19.61

12. $819.20

13. $6.40

14. 12.632 years

15. 883

16. $184,274.23

17.
   a. 8%
   b. $277.64
   c. $55.15

18. 5.904 weeks

19.
   a. Mazda: $y = 19000(0.9)^x$, Ford: $y = 11500\left(1.06^x\right)$
   b. See calculator
   c. 3.068 years

III.

20.
   a. 100/3
   b. -1
   c. 7
   d. $\frac{-3+\ln 3}{2}$
   e. $\frac{5\log 4 - 2\log 9}{3\log 9 + \log 4}$