Practice Questions

Name:

StudentID:

Major:

Time: 120 minutes.

Date: December 8, 2010

1 Venn Diagrams

1. In a trial of a new allergy medicine, 120 people were given the medicin and 80 were given a placebo. Of those given the medicin, 90 showed imporvement on their allergies. Of those given the placebo 20 did not show improvement. Draw a Venn diagram that represent the situation.

2. There are 85 cars on a used car lot. Out of those 85 cars, 24 are Ford and 31 are Dodge, and 25 are red cars. There are 8 red Ford, and 10 red Dodge cars.

   (a) Draw a Venn diagram to illustrate this information. Use the symbols F, D, R to represent the set of Ford, Dodge, and red cars respectively.

   (b) Use your diagram to answer the following:

      i. How many cars (on this lot) are red, but are not Ford and not Dodge.
      ii. How many cars (on this lot) are not red, not Ford, and not Dodge.

3. Of the 60 student in the Pre-Law Club, 26 are taking a philosophy class, 23 are taking a sociology class and 28 are taking a history class. 5 students are taking just sociology. Moreover, 10 students are taking philosophy and history class only, 8 students are taking history and sociology only, and 7 are taking philosophy and sociology only.

   (a) Draw a Venn diagram to illustrate this information. Use the symbols P. S, H to represent the set of students taking philosophy, sociology, and history respectively.

   (b) Use your diagram to answer the following:

      i. How many students are taking all three subjects?
      ii. How many students in the Pre-Law Club are not taking any of these three subjects ?

4. A survey of 210 students at a nonresidential college was taken to determine how they got to campus during the fall term. Of those surveyed, 118 used cars, 82 used public transportation, and 55 used bikes. 28 students used cars and public transportation only, 20 used cars and bikes only, and 26 used public transportation only. 12 students used all three modes of transportation.

(a) Draw a Venn diagram to illustrate this information. Use the symbols PT, C, B to represent the set of students who used public transportation, cars, or bikes, respectively.

(b) Use your diagram to answer the following:

   i. How many students used only cars to get to campus?
   ii. How many students did not use any of the three modes of transportation to get to campus?

2   Truth Tables

Make truth tables for the following statements and decide if they are eqivalent:

1. (a) not (p and q)

    (b) (not p) or (not q)

2. (a) (p or q) and r

    (b) (p and r) or (q and r)

3. (a) (p and q) or r

    (b) (p or r) and (p or q)

4. (a) not (p and q)

    (b) (not p) and (not q)

3   Unit Conversion

1. Apples in France cost 2.50 Euros per kilogram. What is the prize in Dollars per pound? (1 Euro= 1.33 Dollar, 1kg = 2.2 lb)

2. Find a conversion factor between cubic feet and cubic inches.

3. An airliner travels 45 miles in 5 minutes. What is its speed in miles per hour?

4. You plan to travel to Europe. You will take a 1,106 kilometers trip from Rome to Paris and you find out that the cost of gas is $5.64 per gallon. The car that you would like to rent is fuel efficient and uses 1 liter of gas for every 22 kilometers that you drive. How much (in $) will you spend on gas on this trip? (1 liter is 0.2642 gallons)

5. You travel to Italy where the cost of a certain kind of cheese is 7.2 euros per kilogram. Find the cost in dollars per pound. (1 kilogram is 2.2 pounds, 1 euro is 1.32 dollars)

6. You plan to travel to Europe and you are practicing how to deal with different measurement systems. Consider the following situation. Once you arrive in Rome you would like to take a 250 kilometer trip. The car that you would rent uses 0.14 liters of gas per each mile traveled and you find on the Internet that the price of gas is 1.52 dollars per liter. How much in Euros would you spend for gas on this trip? (1 mile is 1.6093 kilometers, 1 Euro is 1.485 dollars)

4 Half-Life, Doubling-Time, Exponential Function

1. Mice population in a particular forest grows at a rate of 2.5% per month.

   (a) How long will it take for this mice population to triple in size?

   (b) If the initial mice population was 50, find the population after 4 years.

2. A community of rabbits has a doubling time of 3 months.

   (a) How long will it take for this rabbit population to triple in size?

   (b) If there are initially 50 rabbits, what will the population be 2 years later?

3. A certain medication breaks down in the human body (decreases) at a rate of 12% per hour.

   (a) Find the approximate half-life.

   (b) Find the exact half-life of that medication in your bloodstream.

   (c) If you took 500 mg of this medication at 2 pm, how much is left in your bloodstream at 9 pm?

4. You take 500 mg of a certain medication at 2 pm. A lab test done at 7 pm shows that you still have 300 mg of that medication left in your bloodstream. (Please include units in your answer.)

   (a) What is the rate of decrease of that medication in your bloodstream?

   (b) What is the exact half-life of that medication in your bloodstream?

5. The number of cells in a tumor doubles every 1.5 months.

   (a) How long will it take for the number of cells to triple?

   (b) If the tumor begins with a single cell, how many cells will there be after 3 years?

6. You take 400 mg of a certain medication at 10 am. The medication is eliminated from your bloodstream exponentially at a rate of 12% per hour.

   (a) How much of this medication is in your bloodstream at 8 pm the same day?

   (b) What is the exact half-life of that medication in your bloodstream?

5   Saving Plans, Loans,. . .

1. You will deposit \$5,000 now into and account with an APR of 2.7% compounded monthly? What will the balance on the account be twenty years from now assuming no withdrawals and no further deposits are made?

2. A savings account pays an annual percentage rate of 2.75 % compounded quarterly.

    (a) Find the annual percentage yield on this account.

    (b) You decide that you would like to make regular quarterly deposits to this account since you would like to have \$450,000 when you retire in 40 years. How much should your quarterly deposits be in order to accomplish your goal?

3. A savings account pays an annual percentage rate of 2.75% compounded quarterly.

    (a) Find the annual percentage yield on this account.

    (b) You decide that you would like to make a regular quarterly deposits to this account since you would like to have \$600,000 when you retire in 40 years. How much should your deposit quarterly in order to accomplish your goal?

4. If you deposit \$6,000 now and you can get an APR of 2.15 % compounded continuously, how much will you have in 17 years?

5. You have found that you are eligible for a 30 year house loan with an annual interest rate (APR) of 6.25%, compounded monthly.

    (a) If you take out this loan for \$250,000, what will your monthly payment be?

    (b) How much will you pay in interest (in \$ terms) over the life of the loan if you take out this loan for \$250,000?

    (c) If you decide instead to get a 20-year loan at the same rate for the same amount, what would your monthly payment be and how much would you save (in dollars) in interest (if you decided to take a 20 year loan instead of 30 year loan)?

6. You have found that you are eligible for a 30 year house loan with annual interest rate (APR) of 6.25%, compounded monthly.

    (a) If you take out this loan for \$220,000, what will your monthly payment be?

    (b) How much will you pay in interest (in \$ terms) over the life of the loan if you take out this loan for \$220,000?

    (c) If you decide instead to get a 20-year loan at the same rate for the same amount, what would your monthly payment be and how much would you save (in dollars) in interest (if you decided to take a 20 year loan instead of 30 year loan).

7. A savings account pays an annual percentage rate (APR) of 3.5% compounded quarterly.

   (a) Find the annual percentage yield (APY) on this account.

   (b) You decide that you would like to make a regular quarterly deposits to this account since you would like to have $500,000 when you retire in 35 years. How much should your quarterly deposits be in order to accomplish your goal?

6 Percentages, Rates

1. Does it make sence: If you earn 20 % more than I do, then I must earn 20 % less than you do.

2. House prices increase 15% one year, and decrease 10% the next year. How much (in % terms) did the house prices change over the 2 year period?

3. Your car is worth $24,000. If the value of your car is depreciating at a rate of 15 % per year, how much will your car be worth 15 years later?
   Does this situation represent a linear or exponential model? Why?

4. The value of your house is increasing at an average rate of 7.5% per year.

   (a) If your house is worth $ 210,000 now, how much will it be worth in 25 years?

   (b) Does this situation represent a linear or exponential model? Why?

5. If property taxes increase 12% in one year and then decrease 5% in the next year, by what percentage did the property tax change over the two-year period?

6. Consider the statement: *The smoking rate among twelfth-graders jumped 20 percent, to 22 percent.* What percentage of twelfth graders smoked before the increase?

7. The percentage of all bachelor's degrees awarded to men dropped from 56% in 1972 to 42% in 2000. Find the relative change.

7 Geometry

1. Consider a cylinder with height $= 15cm$, surface area $= 406.84cm^2$ and volume $= 577.27cm^3$. The cylinder will be scaled down so that the new cylinder will have a height of 2 cm. Find the surface area and the volume of the new cylinder.

2. Consider a cylinder with radius $= 3cm$, surface area $= 245cm^2$, volume $= 282.74cm^3$. The model will be scaled up so that the cylinder will have a radius of 16 cm. What will the surface area and the volume of the cylinder be? (Please include units.)

3. Consider a box with length $= 3cm$, surface area $= 135.74cm^2$ and volume $=$ $97.875cm^3$. The model will be scaled up so that the box will have a length of $25cm$. What is the surface area and the volume of the new box?

4. An empty water tank is in the shape of a sphere with a radius of 24 meters. Water flows into the tank at a rate of 18 cubic yards per second. How many minutes will it take until the tank is full? (1 meter $= 1.094$ yards)

5. An empty water tank is in the shape of a right cylinder with a diameter of 30 meters and a height of 25 meters. Water flows into the tank at a rate of 1 cubic meter per second. How many minutes will it take until the talk is full?

6. Two cylindrical cans of soup sell for the same price. Can A has a diameter of 12 cm and a height of 10 cm. Can B has a diameter of 5 inches and a height of 6 inches. Which can contains more soup and, therefore, is a better buy? (1 inch is 2.54 cm)

8 Linear Functions

1. Find the slope of the line, x and y intercepts: $7x + 4y = 10$.

2. One morning, there were 10 cm of snow on the ground. Then the winter storm started and snow started accumulating at a constant rate of 5 cm every 2 hours.

   (a) Identify the independent and dependent variables.

   (b) Write a linear equation that describes this situation.

3. The following data represents measurement of the concentration of a substance in a patient's bloodstream, after the starts of a treatment meant to boost the concentration:

Days after start of treatment	3	5	8	15
Concentration in ppm	2.6	3.2	4.1	6.2

   (a) Create a linear equation that would represent this situation.

   (b) How long will it take for the concentration to reach 20 ppm?

4. The diameter of a tree increases by 0.5 cm every 3 years. When you started observing the tree, its diameter was 5 cm.

   (a) Write a linear equation that describes this situation.

   (b) When will the tree have a diameter of 16 cm?

9 Algebra

1. Simplify the following expression:

$$\frac{y^4}{(x^{-3}y)^5} \times \frac{x^{-2}}{y^3}.$$

2. Solve for t:

$$\frac{5 - 4t}{3} = \frac{t}{4}.$$

3. $\frac{10}{3} \times \frac{3}{7} =$

4. $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} =$

5. $(3 \times 10^3) \times (2 \times 10^2) =$