Worksheet # 0

Covering Section 1.1

Discussion

1. What are your plans after passing Math 1240?

2. Fill in the People Board by filling in your classmates' names.

Financial Topics	Networks	Probability
Owns a house	Has used a paper map	Played the lottery
Has a credit card	Drives for a delivery service	Has been to a casino
Has a savings account	Lives on a cul-de-sac	Joined an office betting pool

3. What kind of resources are available to you as a Tri-C student if you are struggling in the course?

4. Let's talk about best practices in and outside of the college classroom:

a. Attendance and participation:

b. Asking for help:

c. Turning in assignments:

d. Communicating with your classmates and professor:

e. Preparing for class:

5. Consider the number 13.74962. Round this number …

a. To the nearest whole number

b. To the nearest tenth

c. To the nearest hundredth

d. To the nearest thousandth

6. Let's discuss how to use Desmos.com and review some rounding rules.

   Type in the following:

   - $\frac{100}{125}$ (convert between decimal and fraction)
   - $\left(1 + \frac{0.05}{12}\right)^2$ (use both the square button and the power button)
   - $\left(1 + \frac{0.07}{4}\right)^8$ (round to the nearest tenth, hundredth, and thousandth)
   - $\sqrt{7.8}$ (round to the nearest tenth)
   - $\sqrt[25]{1.056}$ (round to the nearest thousandth)
   - $\frac{\frac{0.025}{12} + 1}{\frac{0.025}{12}}$
   - $\frac{1}{5280} \cdot \frac{60}{7}$ (simplify the fraction)

Worksheet # 1

Covering Section 1.2

Review

1. A fee paid for borrowing money is known as _____.

2. The _____ is the amount of money borrowed.

3. Interest that is charged solely on the principal is known as _____ _____.

4. What is the Simple Interest Formula?

5. What keyword(s) would you look for in the problem to determine if you would use the Simple Interest Formula?

6. Given the following rates, what number would you plug in for r in the Simple Interest Formula?
   a. 5.35%　　　　　　　　b. 8%　　　　　　　　c. 0.54%　　　　　　　　d. 21.87%

7. Given the following lengths of time, what number would you plug in for t in the Simple Interest Formula (assuming the interest rate is annual)?
   a. 28 months　　　　　　　b. 107 days　　　　　　　c. 3 years

8. What value should you use for A if you are planning to...
   a. Double the initial investment?　　　　　　　b) Triple the initial investment?

9. For the following problem, identify the values for *A*, *P*, *r*, and *t* or state that the value is unknown:

a. At the end of 40 months, there was $4050 in the account which had a 7.12% simple annual interest rate.

A = _____ *P*= _____ *r*= _____ *t* = _____

b. An investment of $8,750 grew to $9,012 in 12 years.

A = _____ *P*= _____ *r*= _____ *t* = _____

c. An investment of $12,500 grew to $14,900 in an account that had a 0.67% simple interest rate.

A = _____ *P*= _____ *r*= _____ *t* = _____

d. An investment of $350 is made into an account that offers a 1.94% simple interest rate for 56 months.

A = _____ *P*= _____ *r*= _____ *t* = _____

10. Solve for the missing values in **#9** above. Round to the hundredth place.

11. Consider the following question: *The cost of coffee from Brazil went from $4.05 per pound to $5.75 per pound. What is the percent change?*

Two students wrote the following; however, there is an error in each attempt. What is the error?

$$\frac{4.05 - 5.75}{4.05} \cdot 100\% = -42\%$$

$$\frac{5.75 - 4.05}{5.75} \cdot 100\% = 30\%$$

12. Homework questions?

Discussion

13. Remembering that interest is money paid for the use of money, what are scenarios where you would want a higher interest rate? A lower interest rate?

14. As the interest rate increases, how does that affect the total value in the account?

15. How many times is simple interest calculated for the duration of the account?

Activity

16. Suppose that $100 is deposited into an account that earns an annual interest rate of 2.4%. How much will be in account after 3 months?

17. Taking this ending amount, suppose it's invested at the same rate for the same amount of time? How much will be in the account after the second 3 months?

18. Taking this ending amount, suppose it's invested at the same rate for the same amount of time? How much will be in the account after the third 3 months?

19. Taking this ending amount, suppose it's invested at the same rate for the same amount of time? How much will be in the account after the fourth 3 months?

20. How much has the account earned in that year? What is this value called?

21. How is this value different from computing the interest only once for one year? Why?

Consider the following expression:

$$500(1 + 0.025)^{120}$$

22. Go through the steps on how to evaluate this expression in the calculator.

Consider the following expression:

$$1750\left(1 + \frac{0.0745}{4}\right)^{36}$$

23. Go through the steps on how to evaluate this expression in the calculator.

Consider the following expression:

$$650\left(1 + \frac{0.0145}{2}\right)^{-300}$$

24. Go through the steps on how to evaluate this expression in the calculator.

Consider the formula:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

25. How would you solve for P?

A little progress each day adds up to big results!

Worksheet # 2

Covering Section 1.3

Review

1. Fill the chart in below with the appropriate value of n:

Period	Annually	Semiannually	Quarterly	Monthly	Weekly	Daily
n						

2. What is APY and when is it used?

3. Suppose that $400 is deposited into an account that offers an APR of 1.35% compounded semiannually. How much is in the account after 10 years?

4. Suppose that $1000 is needed in 5 years. You found an account that offers and APR of 0.47% compounded monthly. How much should be deposited now to achieve this goal?

5. You would like to invest $15,000 and make it grow to $20,000 in 6 years. What APR do you need for this to happen?

6. Homework questions?

Discussion

7. Is it possible for the value for *P* in the Present Value formula to be larger than the value for *A*?

8. As the number of compound periods increase, how does that affect the total value in the account?

9. If you had a certain interest rate for a current loan like a car loan and you found a lower rate online, what are your options?

Activity

10. What is 2% of $100,000?

11. What is 3.15% of $225,000?

12. Go through the steps on how to evaluate this expression in the calculator.

$$125000\left(1 + \frac{0.0675}{12}\right)^{12\cdot12} - \frac{810.75\left(\left(1 + \frac{0.0675}{12}\right)^{12\cdot12} - 1\right)}{\left(\frac{0.0675}{12}\right)}$$

13. Go through the steps on how to evaluate this expression in the calculator.

$$\frac{28600\left(\frac{0.0312}{12}\right)}{\left(1-\left(1+\frac{0.0312}{12}\right)^{-12\cdot5}\right)}$$

14. Suppose you paid $950 per month for 30 years on a home loan. How much was paid on the loan?

15. Suppose you paid $950 per month for 30 years on a home loan. The original home loan value was $250,000. How much was paid in interest?

There is no elevator to success. You have to take the stairs!

Worksheet # 3

Covering Section 1.4

Review

1. What does it mean to refinance?

2. What is a down payment?

3. What are closing costs and how do they affect the value of your loan?

4. What does the Amount Owed on a Loan formula tell us?

5. What does the Amortization formula tell us?

6. Suppose you find a home for $220,000. You plan to put down 13.5% and finance the rest on a 5.78% interest rate for 30 years. After 10 years of paying on this loan, you refinance down to a 2.95% for 15 years.

a. What was the original payment on the 30-year loan?

b. How much was in the account after paying for 10 years?

c. Assuming any fees were paid upfront, what is the new payment on the 15-year loan?

d. How much money was saved in interest?

7. Homework questions?

Discussion

8. During the refinance part of **#6**, what are the other items to consider to ensure that he refinance is worth it? Any additional fees that one must pay?

9. In the Amount Owed on a Loan formula, how is the value for *t* different than in the other formulas?

10. When you make a payment on a loan, does 100% of the payment go towards the principal?

Activity

11. Visit the website [Mortgage Calculator](#) to answer the following questions and click on Monthly Schedule.

a. What is the loan amount?

b. What is the loan term and corresponding interest rate?

c. What is the monthly payment?

d. What is the first month where the remaining balance is first below $100,000?

e. Is the interest on this loan ever greater than the principal? Why? What could affect this?

f. If you were to add the amount paid in interest and the amount paid to principal, what should it add up to?

"Whatever you do, always give 100%. Unless you're donating blood."

-Bill Murray

Worksheet # 4

Covering Section 1.5

Review

1. What does an amortization table tell us?

2. What financial formula is used to compute the interest in an amortization table and why?

3. Red Riding Hood and the Wolf make amends and decide to buy a house together. They can afford to spend $1400 per month for the home. They have $15,000 to use for a down payment. They discovered that the loan will carry a PMI of $45 per month and escrow will cover insurance and property taxes for $250 per month. They can get a loan with a fixed 2.985% interest rate for 15 years. How much of a home can they afford?

4. Homework questions?

5. If you are in a scenario where you have two options for an interest rate, one lower with no cash back and one higher with cash back, how do you determine which one will be the more economical?

6. How can you determine whether or not it's a good idea to refinance?

7. What do you think happens to a value of a house over time? How does that relate to equity?

8. What are costs that can be included in escrow?

9. When you make monthly payment, some of the payment goes towards the principal balance and the other part goes towards interest owed. Do you think the amount paid to each part (principal and interest) stays the same each time you pay on your home loan? Why or why not?

10. What is the difference between the purpose of the Present Value and Present Value of an Annuity Formula?

11. What is the purpose of PMI?

Activity

12. Go through the steps on how to evaluate this expression in the calculator.

$$\frac{850.20\left(\left(1+\frac{0.075}{12}\right)^{12*20}-1\right)}{\left(\frac{0.075}{12}\right)}$$

13. Go through the steps on how to evaluate this expression in the calculator.

$$\frac{150{,}000\left(\frac{0.03125}{12}\right)}{\left(\left(1+\frac{0.03125}{12}\right)^{12*40}-1\right)}$$

14. Suppose that you have $400,000 in your retirement account but are in the 23% tax bracket. After paying taxes, how much is left in the account?

15. Suppose you need to have $350,000 in your retirement account after taxes and you are in the 17% tax bracket. How much should you have in the account prior to taxes?

"Skill is only developed by hours and hours of work."

– Usain Bolt

Worksheet # 5

Covering Section 1.6

Review

1. What's a 401-k?

2. When are the following formulas used?

   Future Value of an Annuity   Sinking Fund

   Amortization   Present Value of an Annuity

3. What is an annuity?

4. What does it mean for your employer to match your contributions?

5. What is inflation? What does a 3% inflation rate mean?

6. Homework questions?

Discussion

7. When you are considering starting a retirement account, what are some things that you have to consider?

8. Suppose you have two job offers available which are offering different retirement options. How do you determine which job is a better offer financially?

9. What is the difference in the type of loan between a car loan and a credit card account?

Activity

10. Find the average of the following numbers:
$$\{2, 4, 5, 8, 9, 10, 12, 15\}$$

11. Find the average of the following numbers:
$$\{2, 2, 2, 2, 3, 3, 4, 4, 5, 5, 5, 5, 5, 5\}$$

12. How could your work in #11 have been simplified?

13. Your billing cycle starts on March 1st and goes through the end of the month. How many days are in this cycle?

14. Your billing cycle starts on April 1st and goes through the end of the month. How many days are in this cycle?

15. Your billing cycle starts on the 14th of every month. How many days are in the cycle that starts on
    a. June 14th?   b. July 14th?

"Great things are done by a series of small things brought together." — Vincent Van Gogh

Worksheet # 6

Preparing for the test on Finance

Review

1. How do you find the average daily balance?

2. What is formula for a finance charge?

3. Why do we find an average daily balance?

4. How does the timing of the charge affect the average daily balance?

5. How does the timing of the payment affect the average daily balance?

6. There are two errors in the following table. Find them, fix them, and compute the correct average daily balance. The billing cycle starts on the 12th of each month and there is no carry-over balance.

Number of Days with the Balance	Date	Item	Value	Balance
2	April 12	Bagels and Coffee	$20.75	$20.75
5	April 14	Smart bike	$2300	$2320.75
13	April 19	Payment	-$1500	$3820.75
10	May 2	iPhone 47	$850.50	$4671.25

7. For problem #6, assuming that the APR is 23.70%. Compute the following:
   a. The finance charge for this billing cycle   b. The ending balance

8. What is credit score and what affects it?

9. Homework questions?

Discussion

10. Consider the following scenario:

Marsh invests $1,500 into a bond that offers a 2% rate of return compounded semiannually. After 18 months, he made the following purchases on his credit card that offers a 20.85% interest rate:

- *Beginning balance $3,500 on the 1st day of the cycle*
- *Purchase airline tickets for $1,240 on the 8th day of the cycle*
- *Purchase luggage for $530 on the 20th day of the cycle*
- *Emptied his bond completely to make a payment on the 25th day of the cycle*
- *There are 31 days in the cycle*

He wants to consolidate his loans, which includes the remaining balance on his credit card and his car payment. He wants to pay off the consolidated loan in 36 months.

a. What formula would be used for the first 18 months?

b. What formulas would be needed to determine the ending balance of the credit card loan?

c. What formula would be needed to compute the payment needed to pay off the consolidated loan?

11. For the following formulas, discuss when each one should be used:

Simple Interest: $I = Prt$

Amount of Simple Interest: $A = P + Prt = P(1 + rt)$

Compound Interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Present Value: $P = A\left(1 + \frac{r}{n}\right)^{-nt}$

Annual Percentage Yield: $APY = \left(1 + \frac{r}{n}\right)^n - 1$

Amortization: $PMT = \dfrac{PV\left(\frac{r}{n}\right)}{\left(1 - \left(1 + \frac{r}{n}\right)^{-nt}\right)}$

Amount Owed on a Loan: $A\left(1 + \frac{r}{n}\right)^{nt} - \dfrac{PMT\left(\left(1 + \frac{r}{n}\right)^{nt} - 1\right)}{\left(\frac{r}{n}\right)}$

Present Value of an Annuity: $PV = \dfrac{PMT\left(1 - \left(1 + \frac{r}{n}\right)^{-nt}\right)}{\left(\frac{r}{n}\right)}$

Future Value of an Annuity: $FV = \dfrac{PMT\left(\left(1 + \frac{r}{n}\right)^{nt} - 1\right)}{\left(\frac{r}{n}\right)}$

Sinking Fund: $PMT = \dfrac{FV\left(\frac{r}{n}\right)}{\left(\left(1 + \frac{r}{n}\right)^{nt} - 1\right)}$

Average Daily Balance: $ADB = \dfrac{(number\ of\ days)(beginning\ balance) + (number\ of\ days)(new\ balance) + \cdots}{total\ number\ of\ days}$

"Education is our passport to the future, for tomorrow belongs to the people who prepare for today." $-$Malcom X

Worksheet # 7

Covering Section 2.1

Preview

1. Let's go around the room and get answers for the following questions:

   a. *How many credits are you taking this semester?*

   b. *What do you call a carbonated beverage like Pepsi?*

2. When you think of average what comes to mind?

3. If we were to add all the values in question 1a, what would we get and what does that value mean in the context of the scenario?

4. Referring to question 1a, what number is the average number of credits? What does this value mean in the context of the scenario?

5. Referring to question 1a, if you were to put the numbers in order, what number would be the middle? What does this value mean in the context of the scenario?

6. Referring to question 1a, what is the difference between the highest and the lowest value? What does this value mean in the context of the scenario?

7. Referring to question 1b, what answer occurred the most? Do you know what we call this term in statistics?

8. Consider the following equations. Solve for the variable:

   a. $\dfrac{2+7+9+x}{4} = 12$

   b. $\dfrac{1.8+7.2+8.8+6.3+8.2}{5} = x$

9. Consider the list of numbers below for the following:
$$\{5, 8, 1, 2, 9, 4, 3, 2, 5, 10, 11, 14\}$$

   a. Put these values in order from smallest to largest:

   b. Using your answer from part 9a., split these numbers into four subsets so that there are the same number of numbers in each subset.

10. Consider the list of numbers below for the following:
$$\{4.8, 9.1, 2.5, 5.4, 8, 9.2, 1.5, 4.3, 3.7\}$$

   a. Put these values in order from smallest to largest:

   b. Using your answer from part 10a, split these numbers into four subsets not including the middle number.

Worksheet # 8

Covering Section 2.2

Review

1. Consider the following set for the following questions:

$$\{5, 8, 2, 3, 5, 1, 10, 4, 9\}$$

   a. Find the mean: b. Find the median: c. Find the mode:

   d. Find the midrange   e. Which of the above measures most accurately describes
   the data and why?

   f. Find the quartiles Q_1 and Q_3:

2. Create a set of five positive integers from 1 to 20 that have the same mean, median, and range.

3. Create a statistical data set of at least 10 numbers such that the following conditions are met:

    a. All of the numbers in the data set are whole numbers.

    b. The median is not a whole number.

    c. The median is not part of the data set.

4. Visit the website https://www.geogebra.org/m/t5d9cdyv to review different types of sampling.

5. Homework questions?

Discussion

6. Consider two quarterbacks and their passing yards per game for their last five games. Which quarterback has been more consistent and how do you know?
    Tom Bradybunch: 267, 251, 285, 290, 274
    Butcher Mayfield: 375, 183, 233, 300, 201

7. The Mandi Family hosted two parties in one week. The first party had an age range of 40 years while the second party had an age range of 5 years.
   a. Which party had a greater mixture of ages?

   b. Which party was probably a kid's party?

   c. Which party is most likely a 21st birthday party?

   d. Which party is most like a quinceañera?

Activity

8. Explain the steps necessary to evaluate the following expression:

$$\sqrt{\frac{(5 - 2.4)^2}{1.8}}$$

9. Find the approximate value for the expression in number **8.** rounded to two decimal places.

10. Consider the following simplification process a student used to simplify an expression in their calculator. Locate and correct the error:

a. The student needed to evaluate this $\frac{3+8+9+10+2+3}{6}$.

   They typed this into the calculator: $3 + 8 + 9 + 10 + 2 + 3/6$.

b. The student needed to evaluate this $\frac{(6-4.3)^2}{5-1}$.

   They typed this into the calculator: $(6 - 4.3)^2/5 - 1$.

11. Consider the list possible values for x $\{1, 3, 3, 4, 6, 7, 8, 9, 10\}$.

   a. Find the sum $\sum x$.   b. Subtract 5 from each value in the list.

   c. Find the sum $\sum(x - 5)$

" Cada día trae nuevas opciones."

Every day brings new options.

Worksheet # 9

Covering Section 2.3

⟳ Review

1. What is the difference between range and midrange?

2. What is the difference between variance and standard deviation?

3. What does variability mean in why is it important to measure the variability of a data set?

4. Consider the following standard deviation table. Determine the location of the error.

   a.

x	$x - \bar{x}$	$(x - \bar{x})^2$
1	-1.5	-2.25
2	-0.5	-0.25
3	0.5	0.25
4	1.5	2.25

$\bar{x} = 2.5$

4. continued

b.

x	$x - \bar{x}$	$(x - \bar{x})^2$
2	3.5	12.25
4	1.5	2.25
7	-1.5	2.25
9	-3.5	12.25

$\bar{x} = 5.5$

c.

x	$x - \bar{x}$	$(x - \bar{x})^2$
1	-3	9
3	-1	1
5	1	1
7	3	9

$\bar{x} = 4$ Standard deviation: $\sqrt{9 + 1 + 1 + 9/4 - 1} = \sqrt{12.25} = 3.5$

5. When calculating sample standard deviation using Desmos, do you use stdev or stdevp?

6. Using only numbers 1-9 (without repeating any number), fill in the boxes to create a set of data with the largest possible standard deviation.

☐ , ☐ , ☐ , ☐ ☐ , ☐ ☐ , ☐ ☐

7. Homework questions?

_____

 Discussion

8. Find the sum: 8+8+8+8+8+8+8+8+8+8+8.

9. Is there a faster way to find the sum from number **8.**?

10. While both methods in number **8.** and number **9.** give you the same answer, discuss the pros and cons of each.

11. What do you think the word frequency means? If a number occurs with greater frequency than another, what does that mean?

12. Consider the following set of numbers:
$$\{4, 6, 7, 2, 4, 2, 7, 7, 6, 4, 2, 2, 7, 6, 6, 2, 4, 7, 6\}$$

Think about a way to organize the values to make them easier to read?

13. Share your ideas for this process.

Activity

14. Consider the following age ranges found on a survey. Determine the midrange age for each age group.

Age Range	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Midrange					

15. Consider the following ages of people who took the survey mentioned in number **14.**

$$\{34, 65, 23, 44, 22, 43, 40, 60, 33, 34, 52, 23, 27, 48, 55, 51, 25, 29, 38\}$$

Count the number of people in each of the given age range to complete the table below.

Age Range	20 - 29	30 – 39	40 - 49	50 - 59	60 - 69
Frequency					

16. Copy your work from problems **14.** and **15.** and fill in the last row below.

Age Range	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Midrange					
Frequency					
Midrange x Frequency					

"Sometimes the bravest and most important thing you can do is just show up."

-Brene Brown

Worksheet # 10

Covering Section 2.4

Review

1. What are the pros and cons of a standard deviation and a grouped frequency standard deviation?

2. Consider the following standard deviation table. Determine the location of the error.

x	**Frequency** f	$x - \bar{x}$	$(x - \bar{x})^2$	$f \cdot (x - \bar{x})^2$
1	4	-1.5	2.25	2.25
2	7	-0.5	0.25	0.5
3	7	0.5	0.25	0.75
4	4	1.5	2.25	9

$\bar{x} = 2.5$

3. Consider the table from number **2.** Correct the error and continue to find the standard deviation.

x	**Frequency** f	$x - \bar{x}$	$(x - \bar{x})^2$	$f \cdot (x - \bar{x})^2$
1	4	-1.5	2.25	
2	7	-0.5	0.25	
3	7	0.5	0.25	
4	4	1.5	2.25	

$\bar{x} = 2.5$

4. Annie Edison is taking 5 courses this semester:

Theoretical Phys Ed—4 credit hours—Grade: A   Reading?—4 credit hour—Grade: C
Studyology—5 credit hours—Grade: B   Principles of Intermediate—2 credit hours—Grade: A
Introduction to Basics—3 credit hours—Grade: B

Recall that a grade of an 'A' is worth ___ point, grade of a 'B' is worth __ points, and a grade of a 'C' is worth ___ points, determine Annie's grade point average for the semester rounded to two decimal places:

5. Homework questions?

Discussion

6. Name some ways you've seen data displayed in everyday life. How and when were they used?

7. What are some important items that a graph should include to make it easier to read?

8. Discuss some ways that graphs can correctly display data.

9. Discuss some ways that graphs can incorrectly display data.

10. Consider the following histogram which show the number of minutes customers reported after calling a help center on a select day. Customers were asked to fill out a short survey after their call ended.

Number of Minutes of Wait Time
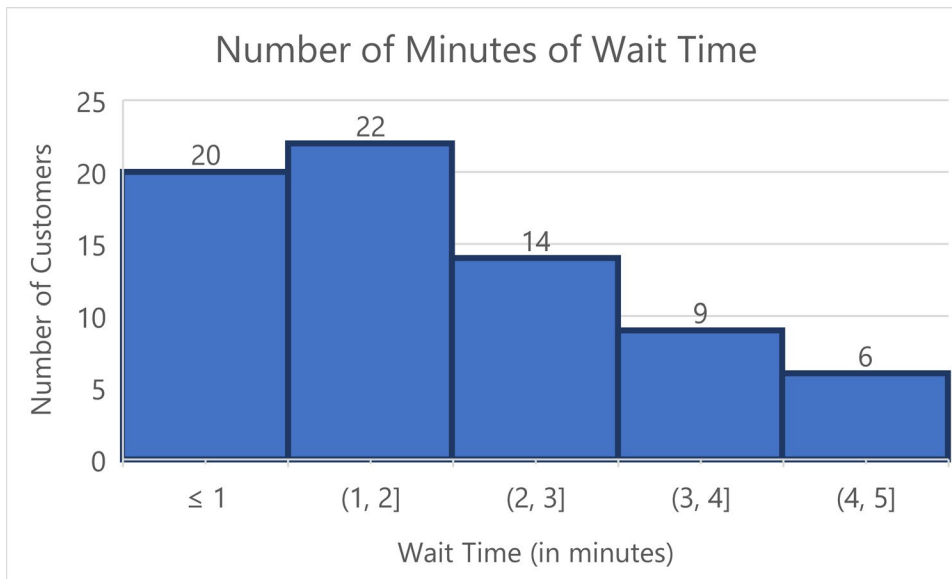
a. How many customers responded to the survey?

b. Of those who responded, how many customers waited 3 minutes or less?

c. Of those who responded, what percentage of customers waited at most 1 minute?

11. Consider the following bar graph.
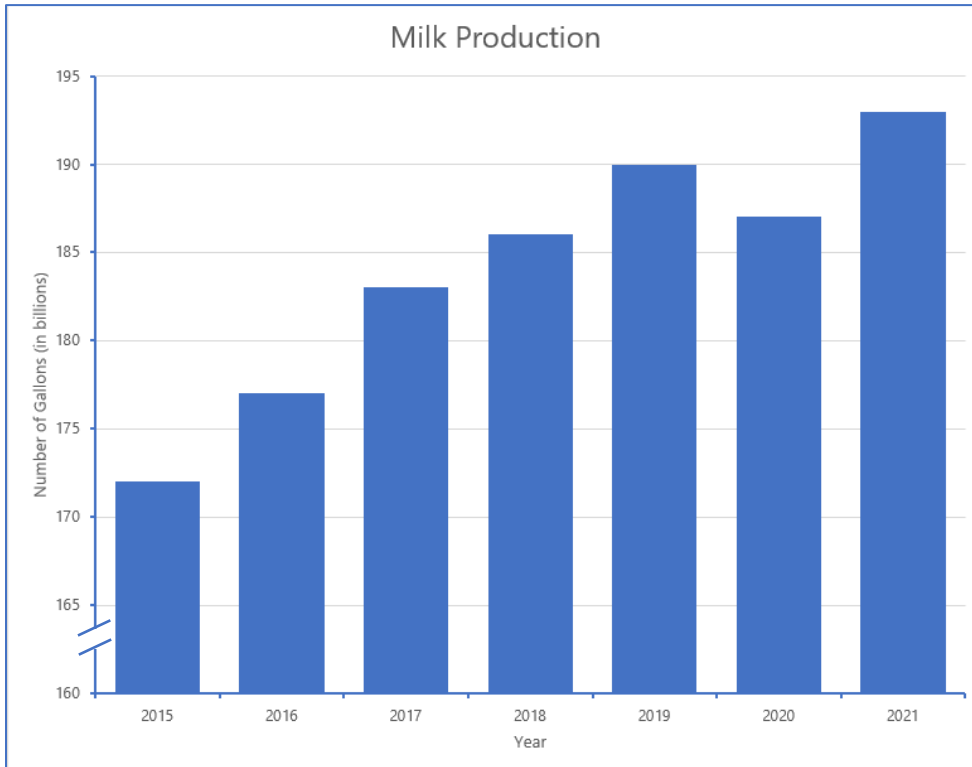
Milk Production

a. In what years was the milk production more than 185 billion gallons?

b. Describe the change from 2015 to 2021.

c. What do the lines between 0 and 165 on the *y*-axis represent?

"A smooth sea never made a skilled sailor."

-Franklin D. Roosevelt

Worksheet # 11

Covering Section 2.5

Review

1. Which type of data is the following most appropriate?
   a. Histogram:

   b. Bar graph:

   c. Line graph/Time-series graph:

   d. Pie graph:

   e. Frequency polygon:

   f. Stem-and-leaf:

2. Search online for a misleading graph and present why it's incorrect and how you would fix it.

3. Consider the following stem-and-leaf graph based on the following data which represents the number of public libraries in select states. Determine what is incorrect about it and how to fix it.

$$\{62, 21, 61, 11, 21, 18, 68, 14, 24, 69, 57, 51, 56\}$$

Stem	Leaf
1	1, 4
2	1, 4
3	0
5	7, 1, 6
6	1289

4. Consider the following bar graph based on the top 5 movies watched on Netflix in 2021. What are the errors and how can they be fixed?

Don't Look Up | The Unforgivable | The Lost Daughter | Back to the Outback | Red Notice
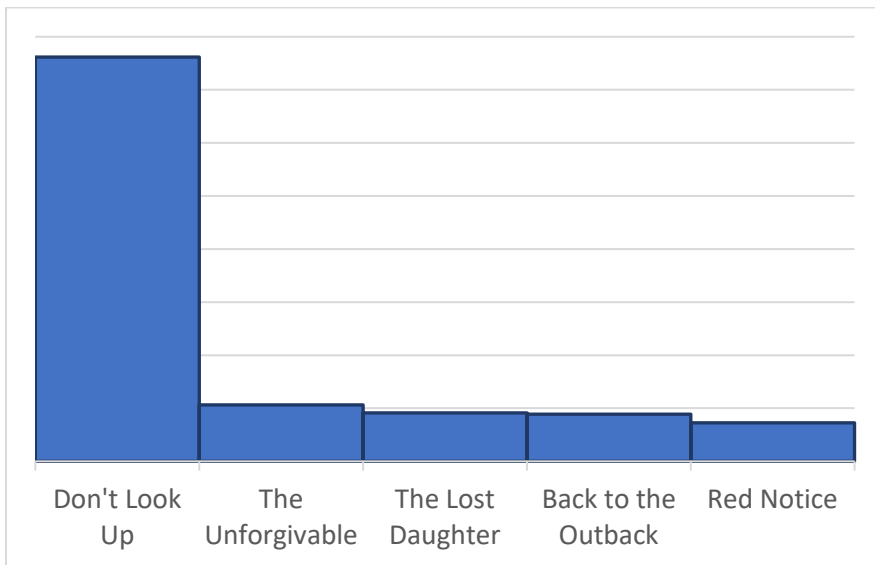
5. Homework questions?

Discussion

6. Finish the following statements:
   a. The more times you attend class…

   b. The less frequent you sleep…

   c. The more hours you work…

7. Consider the following statement. Discuss its implications:

   A recent study concluded that the more books a person owns,
   the more household income they earn.

8. Based on the conclusion from **#7**, would it be wise to order 1,000 books right now?

Activity

9. Plot the following ordered pairs in the graph below. Be sure to label each coordinate.

$$(2,4), (4,2), (0,-3), (-1,1), (-2,0)$$
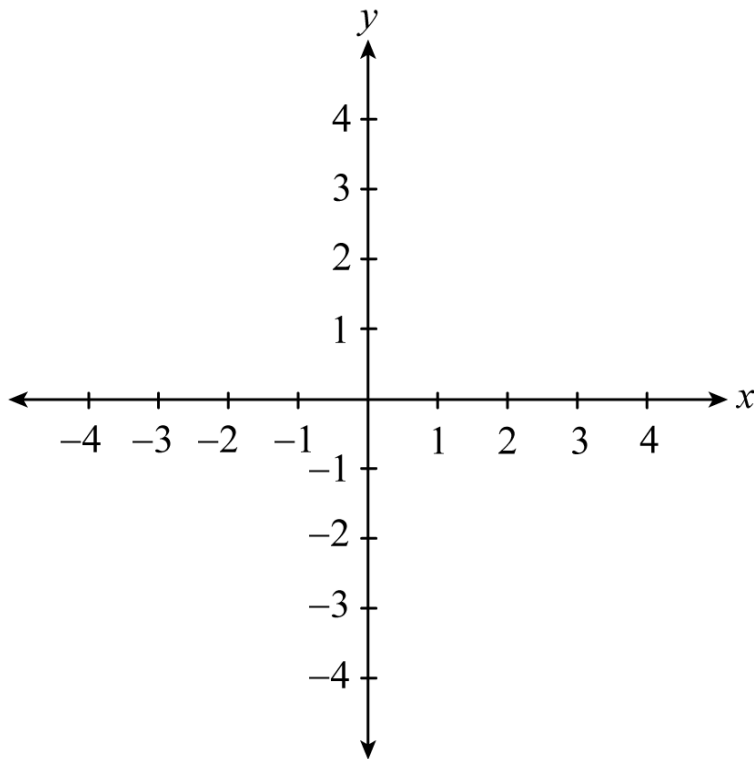
10. Create a table in Desmos to graph the ordered pairs from **#9**.

11. Consider the linear equation $y = \frac{2}{3}x - 5$.

    a. What is the slope?
    b. What is the *y*-intercept?
    c. Does the graph of the line increase or decrease?

"I have not failed. I've just found 10,000 ways that won't work."

— **Thomas A. Edison**

Worksheet # 12

Covering Section 3.9

⟳ Review

1. What is the relationship between *m* and *r*?

2. What do the values of *r* mean in terms of the strength of the correlation between the two variables?

3. What do the values of *r* mean in terms of the direction?

4. For the graph below, determine the data that was used. Also, find the error(s) in the scatter plot and determine how to fix it.
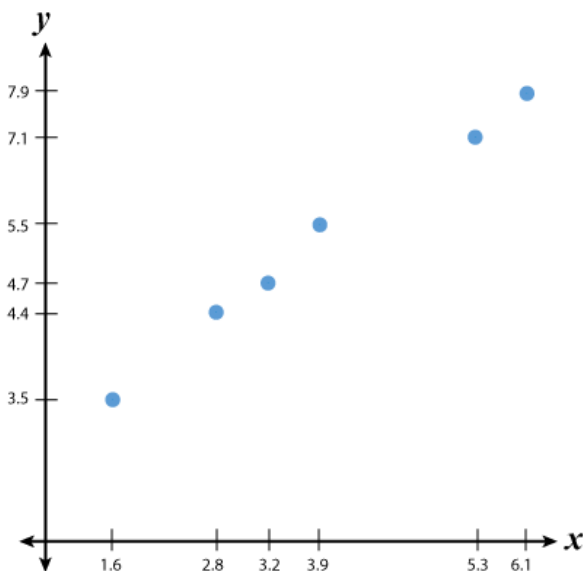
5. Determine if the following scatter plots represent a linear relationship.
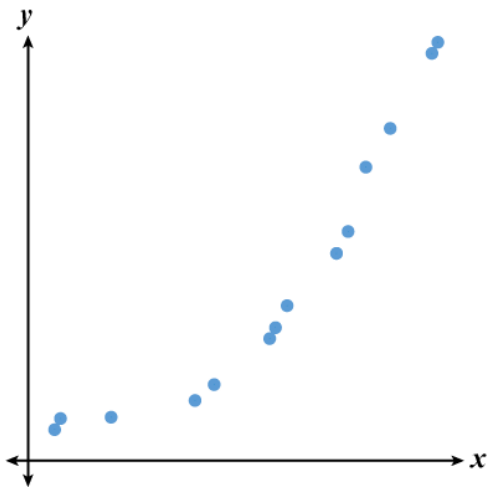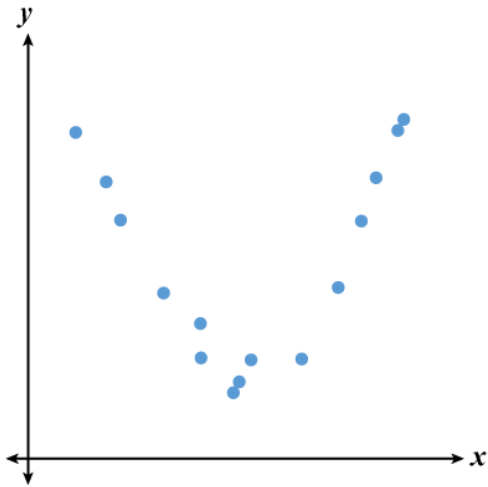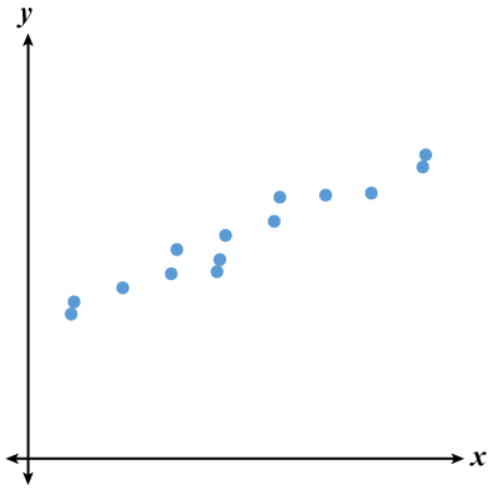
6. Suppose that the independent variable (*x*) represents the time in years since 2015 and the dependent variable (*y*) represents the average home value in a select city in thousands. The slope was determined to be *m* = 2.675 and the *y*-intercept has been found to be (0, 144.6). Interpret the slope and the *y*-intercept in the language of the problem.

7. Homework questions?

Discussion

8. You may have heard of the term "bell curve" in everyday life. What do you think it means?

9. Suppose it was found that 50% of people watched a certain TV series. In a group of 40 people, you ask them if they watched the TV series in question. What do you think would have a high probability of occurring and why:
   A. Twenty of the respondents saying they did watch the TV series.
   B. Ten of the respondents saying they did watch the TV series.
   C. Thirty-five of the respondents saying they did watch the TV series.

10. Roll a die 6 times (go to google.com and type in "roll a die" without quotes). Record the number of times each result occurred and compare it with the class. Did each value happen with a probability of 1/6? Why or why not?

Activity

11. Consider rolling a die 4 times and recording whether the result is even or odd.

a. Fill in the chart below with the corresponding probabilities written as a decimal rounded to four decimal places.

Number of Even Values	Probability
0	
1	
2	
3	
4	

b. Graph the probabilities as a histogram where the *x*-axis is the number of even values and the *y*-axis is the probability.

c. Describe the shape of the histogram.

Review

1. Fill in the Normal Distribution Curve with the corresponding probabilities and *x*-axis values:
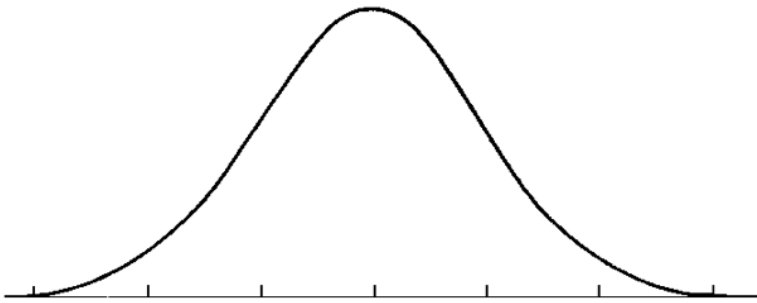
2. The height of second-grade students in a certain school was found to have an average of 49 inches with a standard deviation of 1.7 inches.

a. Fill in the *x*-axis below.
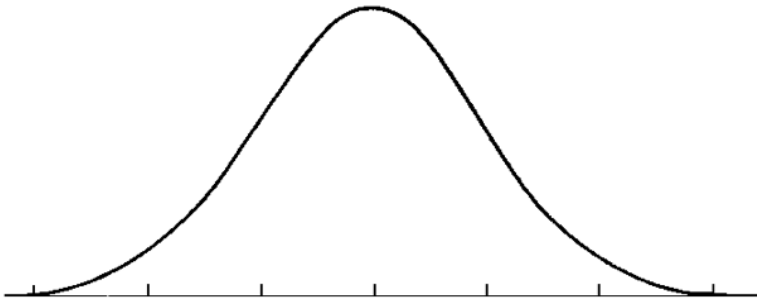
b. Picking a student at random, what is the probability they are at least 52.4 inches tall?

c. Picking a student at random, what is the probability they are between 45.6 and 50.7 inches tall?

3. Homework questions?

---

4. What is the 68-95-99.7% Rule and when is it used?

5. It was found that the average height of males is 70 inches with a standard deviation of 3 inches. For females, the average height is 64.5 inches with a standard deviation of 2.5 inches.

a. Fill in the normal curve for each group:

People that identify as male:
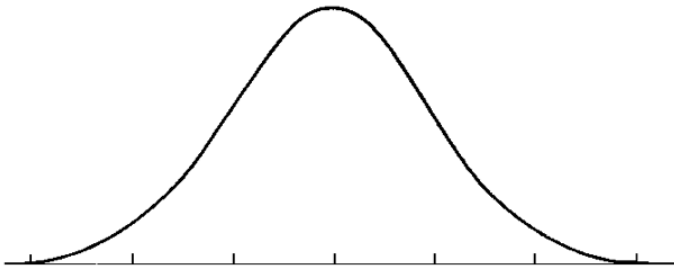
People that identify as female:
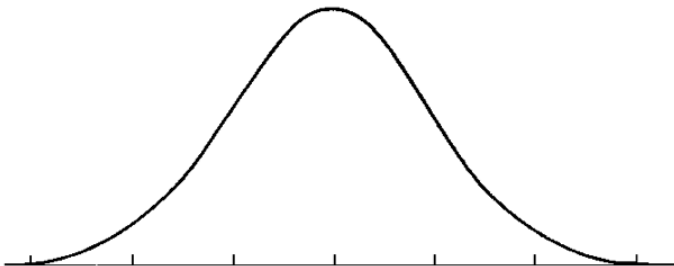
b. Mark your height on the appropriate graph's *x*-axis. Was your height exactly on one of the tick marks?

Activity

6. Using the formula $z = \frac{x - \bar{x}}{s}$, solve for the missing variable given information:

a. Find z given that $x = 6.3$, $\bar{x} = 1.5$, and $s = 2.3$. Round answer to two places.

b. Find x given that $z = -2.95$, $\bar{x} = 8.6$, and $s = 4.2$.

c. Find s given that $z = 1.12$, $x = 4$, and $\bar{x} = 3.3$.

7. The average age of students who attend Tri-C is 29 years old with a standard deviation of 3.6 years. Using this information, fill in the x-axis of the graphs below and shade the appropriate regions.

a. Students who are at least 35 years old:
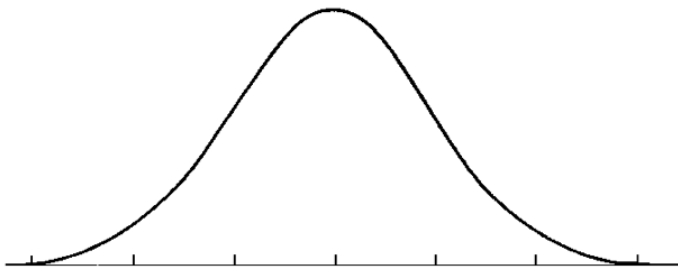
Exercise #7 continued

b. Students who are at most 20 years old:
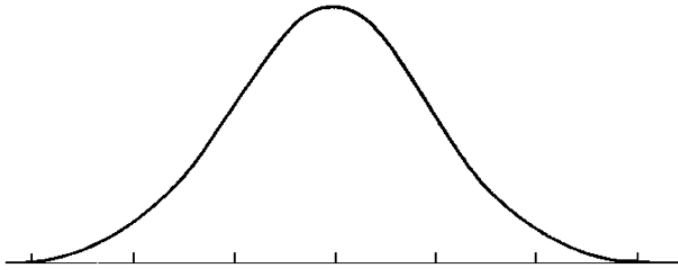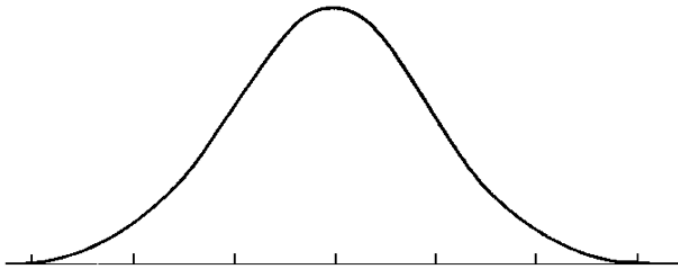
c. People who are between 25 and 38 years old:

d. Students who are younger than 28 or older than 40:
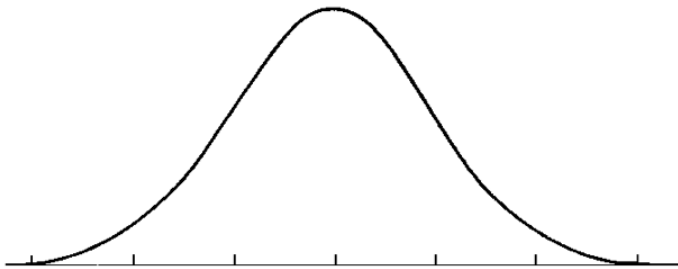
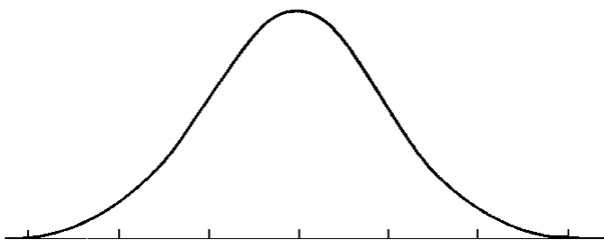# Worksheet # 14

Preparing for the test on Statistics

Review

1. The average age of students who attend Tri-C is 29 years old with a standard deviation of 3.6 years. Picking a student at random, find the probabilities of the following events and shade the corresponding regions:
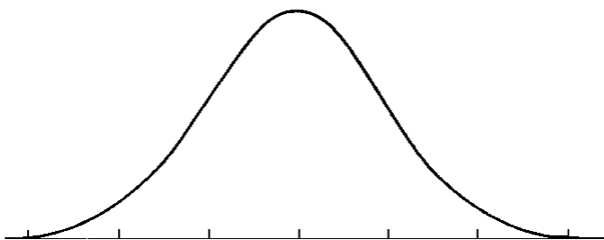
a. Students who are at least 35 years old:
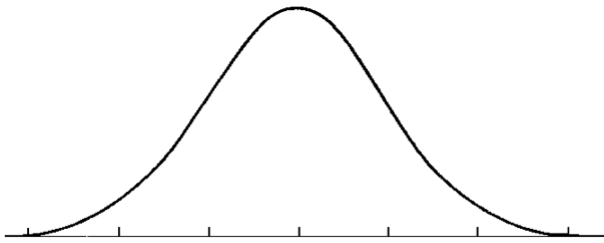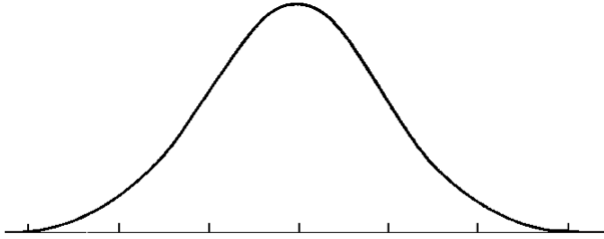
b. Students who are at most 20 years old:

c. People who are between 25 and 38 years old:

Exercise #1 continued

d. Students who are younger than 28 or older than 40:

2. Find and correct the errors to the following questions.

a. It was found that the average weight of a male Siberian husky is 53 pounds with a standard deviation of 1.8 pounds. What is the probability that, picking a male husky at random, they weigh less than 56.6 pounds?

Student answer: $z = \frac{56.6-53}{1.8} = 2.00$. Thus, the probability is 2%.

b. The average wait on hold for a certain call center is 5.7 minutes with a standard deviation of 0.95 minutes. Find the probability that a random call has a wait time of longer than 7 minutes.

Student answer: $z = \frac{5.7-7}{0.95} = -1.36$. Thus, the probability is 91%.

c. The average petal size of a gerbera daisy is 4.2 inches with a standard deviation of 0.47 inches. Picking a gerbera daisy at random, find the probability that a petal is at most 3.8 inches long.

Student answer: $z = \frac{3.8-4.2}{0.47} = -0.85$. Thus, the probability is 80%.

Exercise #2 continued

d. In a study of the BCAA daily intake of athletes, it was found that they consume and average of 30.6 grams daily with a standard deviation of 2.3 grams. Picking an athlete randomly, find the probability that they consume between 27 and 32 grams of BCAAs daily.

Student answer: $z = \frac{27-30.6}{2.3} = -1.57; z = \frac{32-30.6}{2.3} = 0.61$. Using $z = 0.61 - (-1.57) = 2.18$, the probability is 98.5%.

3. Homework questions?

Discussion

4. For a given data set, explain how to find the...
a. Mean

b. Median

c. Mode

d. Midrange

e. Range

f. Quartiles

g. Standard Deviation of ungrouped data

h. Standard Deviation of grouped data

5. Consider the following data:

{12, 17, 18, 12, 11, 13, 20, 21, 14, 13, 17, 19, 12, 16}

Find the following:

a. Mean

b. Median

c. Mode

d. Midrange

e. Range

f. Quartiles

g. Standard Deviation of ungrouped data

"You don't have to be perfect, but you do have to be 100% committed."
– Alexandria Ocasio-Cortez

Worksheet # 15

Covering Section 3.1

Preview

1. Convert $\frac{1}{12}$ to a ...
a. Decimal

b. Percent

c. Percent rounded to the nearest tenth

2. Convert $\frac{2}{3}$ to a ...
a. Decimal

b. Percent

c. Percent rounded to the nearest hundredth

3. Convert $\frac{449}{1000}$ to a ...
a. Decimal

b. Percent

c. Percent rounded to the nearest whole number

4. Reduce the following fractions

a. $\frac{4}{18}$

b. $\frac{312}{2,598,960}$

5. Consider a standard deck of playing cards.

a. How many cards in a deck (not including Jokers).

b. What colors are they?

c. What are the suits?

d. What are the values?

e. Which cards are called "face cards" and why?

6. Consider a six-sided die. Write all the possibilities that you can roll with this die.

7. Consider two six-sided dice. Give three examples of rolls you can do with the dice.

8. Define "probability" in your own words.

9. Define "impossible" in your own words.

10. Define "fair" and "unfair" in your own words.

11. Play some Farkle! http://www.playonlinedicegames.com/farkle

Never give up because great things take time.

-Anonymous

Worksheet # 16

Covering Section 3.2

Review

1. Define the following:

    a. Sample space

    b. Outcome

    c. Event

    d. Fair

    e. Impossible

    f. $n(A)$

    g. $P(A)$

2. When you add up all of the probabilities for a sample space, what should it always equal?

3. Give an example where the probability of an event is 40%.

4. Give an example where the probability of an event is $\frac{14}{9}$.

5. Create a tree diagram related to a three-question true/false test showing the possible answers a student could give.

6. A student said that probability of it snowing in August was ∅. Is this correct?

7. Homework questions?

8. What does "at most" mean?

9. What does "at least" mean?

10. When ordering a coffee, you are usually asked if you want "cream or sugar". When you are ordering an entrée, you are asked if you want "soup or salad". How is the word "or" used in each phrase?

11. Consider the following pairs of events:

    E: Doing your homework.

    F: Taking a nap.

    E: Driving.

    F: Listening to music.

    Which pair can happen at the same time and which pair cannot? Do you know a term for this?

12. Can a number be even and odd at the same time? Can a number be even and prime at the same time?

13. Create two events that are mutually exclusive and are not mutually exclusive.

Activity

14. How many people in this room have a cat? Have a dog?

15. Have a cat or a dog?

16. What is the relationship between your answers in **#14** and **#15** above?

17. Convert the following directions to include the word "or".

a. A family has two children. Find the probability that they have at least one boy.

b. A die is rolled. Find the probability that an even number is rolled.

"You are never too old to set another goal or to dream a new dream."

- C. S. Lewis

Worksheet # 17

Covering Section 3.3

Review

1. Write the two probability formulas related to the word "or".

2. How do you know when to use which formulas from **#1**?

3. Define the following:

    a. Mutually exclusive

    b. ∪

    c. ∩

4. Consider the following data. A student tried to find the probability of picking a person under 40 years old or a lawyer but a mistake was made. Find the error and find the correct answer.

	Lawyer	Doctor	Educator	TOTAL
Under 40 years old	18	20	45	83
40 or older	32	22	16	70
TOTAL	50	42	61	153

$$P(Under\ 40\ OR\ Lawyer) = \frac{83 + 50}{153} = \frac{133}{153}$$

5. Referring to **#4**, how many people were being selected?

6. Homework questions?

Discussion

7. Suppose the chance of snow on given day in early January was 80%. What is the chance that it will not snow that day?

8. Suppose the chance of pulling a red die from a bag filled with dice is $\frac{11}{32}$. What is the chance of not pulling a red die from the bag?

9. Suppose the chance of not being in a car accident is 0.9982. What is the chance of being in a car accident?

10. If you were to add the given probability and the probability you found for questions **#7**, **#8**, and **#9**, what should you always get.

Activity

11. During a magic show, adults with at least one child were asked to stand up. How would you describe the adults who did not stand up?

12. Students were asked to tour the natural history museum to look for 12 artifacts during a school trip. Students who had found all of the selected artifacts won a prize. How many artifacts did the students who did not qualify for the prize find?

13. Suppose a friend selected a card from a standard deck and told you that it was a heart or a king. What card could have been picked?

14. Suppose a friend selected a card from a standard deck and told you that it was a face card or red. What card could have been picked?

15. In a box of chocolate, there are 12 chocolate peanut butter pieces, 15 dark chocolate marshmallow pieces, 7 salted caramel pieces, and 6 toffee-covered pieces. How many pieces are...
a. Chocolate peanut butter pieces and are not chocolate peanut butter pieces?

b. Your favorite and not your favorite?

16. Write your answers to both parts of **#15** as a ratio.

Worksheet # 18

Covering Section 3.4

Review

1. Give an example of an experiment where the word "not" is used.

2. Give an example of an experiment where the word "not" is not used but you should use the complement to solve it.

3. Find the error in the calculation below.

a. Consider picking a card from a standard deck of cards. Determine the probability of not picking a face card.

Student's work:

$$1 - \frac{number\ of\ face\ cards}{number\ of\ cards} = 1 - \frac{40}{52} = \frac{52}{52} - \frac{40}{52} = \frac{12}{52} = \frac{3}{13}$$

b. In a basket of fruit there are 4 bananas, 6 apples, 5 oranges, 2 bunches of grapes, and 1 pineapple. Picking of piece of fruit at random, what are the odds of picking a fruit that is not apples nor bananas?

Student's work:

$$1 - \frac{6}{18} + \frac{4}{18} = \frac{18}{18} - \frac{6}{18} + \frac{4}{18} = \frac{16}{18} = \frac{8}{9}$$

4. Consider a room of 10 people. Write the complement of the following directions. Do not actually solve the problem.

a. Find the probability that all the people in the room watch *Arrested Development.*

b. Find the probability that at least 3 people have a dog.

c. Find the probability that no one has traveled outside of the country.

5. Compare and contrast odds and probability.

6. Find the error(s) in the calculation below.

a. Consider picking a card from a standard deck of cards. Determine the odds of not picking a face card.

Student's work:

$$\frac{number\ of\ cards\ that\ are\ not\ face\ cards}{number\ of\ cards} = \frac{12}{52} = \frac{3}{13}$$

b. In a basket of fruit there are 4 bananas, 6 apples, 5 oranges, 2 bunches of grapes, and 1 pineapple. Picking of piece of fruit at random, what is the probability of picking a fruit that is not apples nor bananas?

Student's work:

$$apples\ and\ bananas : neither\ apples\ nor\ bananas$$
$$10 : 8$$

7. Homework questions?

Discussion

8. Consider the following pairs of events. Can the occurrence of one event affect the other?
   a. *E: Your car not starting.*
      F: Arriving late to work.

   b. *E: Finding $20 in your pocket.*
      F: Tripping over your shoelace.

9. Brainstorm some ways to tell if one event affects another.

10. Discuss the difference between the following statements:
    a. Pick a person that is a woman and a doctorate
    b. Pick a woman and a doctorate.

11. Suppose you were playing cards with a friend and they received a King as their first card. Would you have a better chance of getting a king for your turn if your friend's card was placed back into the deck or left out?

12. Suppose you visit Panera for lunch and decide to go with their You Pick 2 option. You can choose one of three soups: wild rice, broccoli cheddar, and chicken noodle and you can pick one of two sandwiches: grilled cheese and tomato-mozzarella.

a. What are the possible lunch pairings that can be made?

b. Support your answer in **#12a** with a tree diagram.

13. Evaluate the following in your calculator or Desmos.

a. 5!

b. $\frac{7!}{2!}$

c. $\frac{8!}{6!2!}$

14. Given the word "TOY", rearrange the letters to create new real or imaginary words.

15. Given the word "BOB", rearrange the letters to create new real or imaginary words.

16. Explain why there were more words created in **#14** as opposed to **#15**.

Worksheet # 19

Covering Section 3.5

Review

1. What does the symbol ! mean in mathematics?

2. What does it mean for two events to be independent?

3. What word, stated or implied, should prompt multiplication of the number of outcomes?

4. Explain the Fundamental Counting Principle.

5. Find the total number of outcomes in the experiments below.

a. The new Pi-Phone has been released and has several options. You can choose from 4 colors, 3 sizes of hard drive, 2 camera resolutions, and 3 screen sizes. How many different Pi-Phones can be constructed?

b. A library orders 12 copies of *A Spy Who Loves Math*, 4 copies of *Are you My Math Prof?*, and 6 copies of *The Neverending Math Problem*. How many ways can all the books be placed on the shelf?

6. Homework questions?

Discussion

7. When the question says "How many ways…." what kind of answer is expected?

8. When the question says "What is the probability that…" what kind of answer is expected?

9. Considering the formula Arrangements with Multiple Repeats, why was it necessary to divide by the number of each item factorial?

10. Suppose there are 30 people in the room. You were told that 20 people like Show A and 15 people like Show B. How is this possible?

11. Suppose there are 30 people in the room. You were told that 20 people like Show A and 15 people like Show B. Suppose you wanted to only survey the people that like Show B. What would the denominator of the probability be?

12. Suppose there are 30 people in the room. You were told that 20 people like Show A and 15 people like Show B. Suppose you wanted to only survey the people that like Show B. From that group, you find that 8 of them also like Show A. What is the probability that, out of the group that likes Show B, they also like Show A?

13. Suppose there are 30 people in the room. You were told that 20 people like Show A and 15 people like Show B. Suppose you wanted to only survey the people that like Show B. From that group, you find that 8 of them also like Show A. Create a Venn Diagram of this scenario.

A   B

Activity
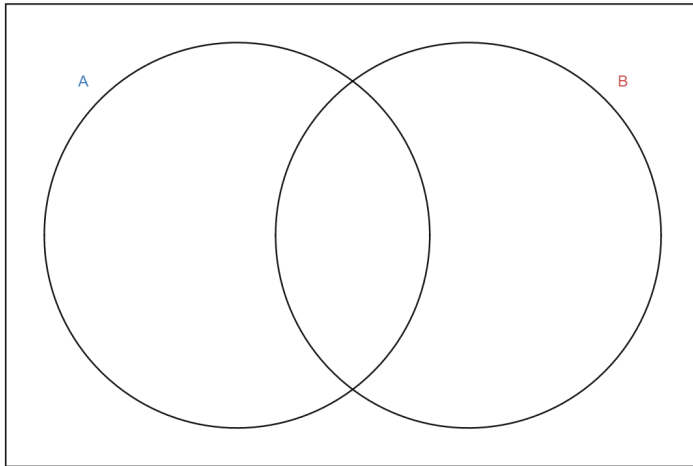
14. Multiply and simplify (as needed) the following fractions:

a. $\frac{1}{5} \cdot \frac{1}{4}$

b. $\frac{12}{28} \cdot \frac{7}{18}$

c. $\frac{3}{16} \cdot \frac{8}{12} \cdot \frac{4}{27}$

15. How many ways can one four-sided die be rolled? List the possible ways.

16. How many ways can two four-sided dice be rolled? List the possible ways.

17. Consider the equation $15 = \frac{a}{3}$. Solve for a.

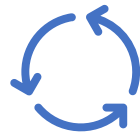18. Consider the equation $16 = \frac{4}{b}$. Solve for b.

19. Consider the equation $\frac{2}{5} = \frac{4}{9}c$. Solve for c.

"It does not matter how slowly you go as long as you do not stop."
- **Confucius**

Worksheet # 20

Covering Section 3.6

Review

1. Consider the information below which shows the number of people by age group and their favorite streaming service. Fill in the TOTAL row and column and use this information to answer the following questions.

Age Group/ Streaming Service	Netflix	Disney+	Hulu	TOTAL
6 – 18	5	32	17	
19 – 45	22	18	10	
46+	30	8	22	
TOTAL				

a. Picking a person at random, what is the probability they prefer Disney+?

b. Picking a person at random, what is the probability they are between the ages of 19 and 45?

c. Picking a person at random, what is the probability they are between 19 and 45 given that they like Disney+?

d. Picking a person at random, what is the probability they prefer Disney+ given they are between 19 and 45?

e. Picking a person at random, what is the probability that they prefer Disney+ and are between 19 and 45?

f. Regarding parts **c – e**, why are all these answers different?

2. Suppose the graphic below is hanging on a wall and you will throw darts at it to "pick" one of the shapes or colors. Assume that every time a dart is thrown, it hits one of the shapes (that is, there are no misses). Once a dart is thrown, its target is noted, and the dart removed from the wall.
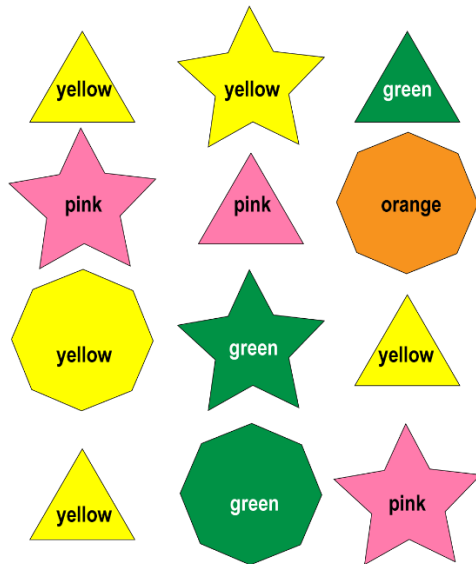
a. In this scenario, for multiple dart throws, are the throws independent or dependent?

b. Picking a shape at random, what is the probability that it is yellow?

c. Picking two shapes at random, what is the probability they are both yellow assuming independence?

d. Picking two shapes at random, what is the probability that the first is yellow and the second is green?

e. Rewrite part **c** where the word "and" is stated.

f. What is the probability that the shape randomly picked is a star or pink?

g. What is the probability that the shaped picked is green given it's a triangle?

h. What is the probability that the shaped picked is green given it's yellow?

i. What is the probability that the shape is not pink given it's not a star?

3. Homework questions?

___

Discussion

4. In a conditional probability, why is the denominator not equal to the total number of outcomes?

5. What key word indicates that the probability in question is conditional?

6. What does it mean to "put something in order"?

7. Consider the following scenarios. Is the order in which the task is completed important?

a. Arranging books on a shelf by the Dewey Decimal System.

b. Hanging shirts in a closet.

c. Picking a team on board game night.

d. The results of a marathon.

e. Forming a committee.

Activity

8. Evaluate the following. *Don't worry if you haven't seen these notations yet!*
a. $4!$

b. $\frac{9!}{6!}$

c. $\frac{9!}{3!6!}$

d. $P(9,3)$

e. $C(9,3)$

9. Suppose you had three pairs of shoes and you were going to pick two pairs to take on vacation. How many ways can you pick those shoes for your trip?

10. Continuing with **#9**, suppose you were going to wear one pair the entire first day and the other pair the entire second day. How many ways can that happen?

"And that's why you always leave a note."

-Walter Weatherman

Worksheet # 21

Covering Section 3.7

Review

1. What is the difference between a permutation and a combination?

2. What property do permutations and combinations have in common?

3. Determine if the following situations represent a permutation, a combination, or neither. Do not actually solve.

a. The number of ways to pick 5 people from 20 to serve on a committee.

b. The number of ways a horse race can finish.

c. The number of ways to create an outfit from 5 shirts and 6 pairs of pants.

d. The number of ways to arrange 10 books on a shelf where there are 5 copies each of two different books.

4. Homework questions?

5. What type of number would you respond with if the question started off with…

a. "How many ways can you…"

b. "What is the probability that…"

6. Define the following poker hands:

a. Royal flush

b. Straight flush

c. Flush

d. Full House

e. Four of a kind

f. Two pair

7. Of those listed in **#6**, which one do you think will be the hardest to achieve?

Activity

8. Recall that there are 12 face cards in a standard deck of 52 cards.
    a. How many ways can 5 face cards be picked?

    b. How many ways can 5 cards (of any type) be picked?

    c. If you put the answer for **a.** over the answer for **b.** as a fraction, what would that fraction represent?

9. Suppose there are 3 different-shaped blue vases (cylindrical, spherical, and box) and 4 different-shaped red vases (cylindrical, spherical, box, and trapezoidal).
    a. How many ways can all the vases be arranged on a shelf if the blue vases are first and then followed by the red vases?

    b. How many ways can all the vases be arranged on the shelf without regard to their color?

    c. If you put the answer for **a.** over the answer for **b.** as a fraction, what would that fraction represent?

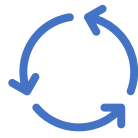10. Simplify the following.

a. $\dfrac{P(4,3)}{P(10,3)}$

b. $\dfrac{P(4,3) \cdot P(6,2)}{P(10,5)}$

c. $\dfrac{5 \cdot P(3,2)}{P(6,2)}$

"If everyone is moving forward together, then success takes care of itself."

-Henry Ford

Worksheet # 22

Covering Section 3.8

 Review

1. Determine if there is a mistake made in the calculation of the answer. If so correct it. Otherwise justify the given answer.

a. There are 3 horses in a race. What is the probability that you correctly pick the first, second, and third place winner?

Student's answer:
$P(3,3) = 6$

b. A florist has 20 flowers of various shapes and sizes to use in the vase: 10 daisies and 10 lilies. Picking 7 flowers total, what is the probability that he picks 5 daisies and 3 lilies?

Student's answer:
$$\frac{P(10,5) \cdot P(10,2)}{P(20,7)} = \frac{30,240 \cdot 90}{390,700,800} = \frac{9}{1292}$$

c. You decide to play the lottery. You need to pick 6 numbers out of 40. You buy 5 unique tickets. What is the probability that you'll win?

Student's answer:
$$\frac{1}{C(40,6)} = \frac{1}{3,838,380}$$

d. Going on a family vacation, you are trying to decide between two genres of board games to bring. You have 12 worker-placement games and 8 roll & write games. Picking four games, what is the probability that you bring either 4 worker-placement games or 4 roll & write games?

Student's answer:
$$\frac{C(12,4) \cdot C(8,4)}{C(20,8)} = \frac{495 \cdot 70}{125,970} = \frac{1,155}{4,199}$$

2. Homework questions?

Discussion

3. Consider the following scenario and then answer the questions that follow.
   From a recent survey it was found that 65% of Americans are in favor of keeping Standard Time throughout the year. You decide to individually ask 10 of your friends what they think.
a. If you were expecting a definitive answer, what answers can you friends give?

b. Are you asking more than one person?

c. Will one friend's answer affect another friend's answer in this scenario?

d. What is the probability that any individual friend will say that they are in favor? They are not in favor?

4. Consider the following scenario and then answer the questions that follow.
   You decide to survey local ice cream shops and ask their patrons which of the following base flavors is their favorite: chocolate, vanilla, or strawberry. In a certain shop, you survey 15 customers.
a. If you were expecting a definitive answer, what answers can the patrons give?

b. Are you asking more than one person?

c. Suppose that we knew that 40% of people were going to say that chocolate was their favorite. What percentage of people would say that strawberry is their favorite?

d. If someone says that vanilla is their favorite, does that affect anyone else giving their answer?

5. Consider the following scenario and then answer the questions that follow.
   Professor Plum decides to play the Straw Game with several of his 7 friends. Each person takes one straw one the one with the shortest straw wins. If Professor Plum is the 4ᵗʰ person to pick a straw, what is the probability that he'll win?

a. What are the possible endgame scenarios for Professor Plum's pick?

b. Is more than one person playing the game?

c. Does one person's pick affect another person's pick?

d. Does the order in which the people play the game make a difference?

Activity

6. If the probability of picking pink as your favorite color is 12.6%, what is the probability that pink is not your favorite color?

7. If the probability of being the victim of credit card theft is 0.0023, what is the probability that you will not be the victim of credit card theft?

8. If the probability of the Oranges winning the Super Bowl is $\frac{2}{397}$. What is the probability that they will not win the Super Bowl?

9. Suppose in a room of 10 people, you wanted to know the probability that at least 8 people watched a certain show. How can you write this question using the word "exactly" and the word "or"?

10. Suppose in a room of 10 people, you wanted to know the probability that at most 8 people watched a certain show. How can you write this question using the word "exactly" and the word "or"?

11. Simplify the following.

a. $C(10,4)(0.33)^4(0.67)^6$

b. $C(8,2)\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^6$

Worksheet # 23

Covering Section 3.11

↻ Review

1. What are the four requirements for a Binomial Probability?

2. If the probability of success is 0.477, what is the probability of failure?

3. Why is a combination necessary in the Binomial Probability formula?

4. Determine if the following scenarios represent a Binomial Probability or not. If not, explain what can be changed to meet the four requirements.

a. A bag contains red, green, and blue marbles. Ten marbles are taken at random, one at a time. Each marble's color is recorded, and then returned to the bag.

b. A basketball player is practicing taking shots. The number of successful shots out of 10 attempts is recorded.

c. A bag contains red, green and blue marbles. Ten marbles are taken from the bag at random one at a time and replaced immediately. The number of green marbles taken is recorded.

5. When can the complement be utilized when doing binomial probability?

6. A survey found that 36% of homes in a certain city have a high-efficiency furnace. You ask four homeowners if they have a high-efficiency furnace in their home.
a. Explain why this scenario represents a Binomial Probability.

b. What is the probability that exactly 2 of the homes have a high-efficiency furnace?

c. What is the probability that at most 2 of the homes have a high-efficiency furnace?

7. Homework questions?

Discussion

8. Suppose there were 100 people in a room and that the probability of someone in the room having red hair is 12%. How many redheads would you expect there to be in the room?

9. Suppose there are 48 people at a movie screening which had a Rotten Tomatoes favorability score of 37%. How many people at the screening would you expect to say they enjoyed the movie?

10. Which of the following would you consider to be a game that would be favorable to play?
a. A carnival game where you toss ping pong balls into fishbowls.

b. Playing with a roulette wheel where you bet on black.

c. A major league baseball team playing against a minor league baseball team.

11. Let's reconsider exercise **#10** now from a different perspective. Which of the following would you consider to be a game that would be favorable to play?
a. A carnival game where you toss ping pong balls into fishbowls from the point of view of the carnival worker.

b. Playing with a roulette wheel where you bet on black from the point of the view of the casino.

d. A major league baseball team playing against a minor league baseball team from the perspective of the minor league team.

12. If you sum up the probabilities of a sample space, what should you always get?

13. Write the sample space where there is a game where a first, second, and third place prize is awarded.

Activity

14. Compute the following:

   a. $200 \cdot \frac{5}{8}$

   b. $-43 \cdot \frac{1}{12}$

   c. $130 \cdot \frac{2}{5} + 160 \cdot \frac{3}{5}$

   d. $-15 \cdot 0.998 + 17 \cdot 0.002$

15. Given the chart below, find $\sum x \cdot P(x)$.

x	1	2	3	4
$P(x)$	$\dfrac{1}{12}$	$\dfrac{1}{4}$	$\dfrac{5}{12}$	$\dfrac{1}{4}$

16. Referring to **#15**, find the sum of the probabilities $P(x)$. Was this value to be expected?

"It always seems impossible until it's done."

*   *Nelson Mandela*

Worksheet # 24

Review for Probability Test

Review

1. What is expected value?

2. Define favorable, unfavorable, and fair in terms of expected value.

3. What are net winnings?

4. A raffle is being held where 2,500 tickets were sold for $15 each. One first place ticket brings in a prize of $1000. Five second place prizes are for $400 each. Ten third place prizes are for $200 each. Rounding answers (in dollars) to two decimal places…

a. What is the expected net value of the game?

b. Is the game fair to play? Why or why not?

5. Marian the Librarian is running to be on her city's library board of trustees. Polling people in the different regions of the city, she found the likelihood of the residents voting for her. The results are shown below. Based on this information, is Marian expected to win the vote?

Group	Percent of Population	Probability the Group will Vote for Marian
District A	23%	43%
District B	58%	62%
District C	19%	49%

6. Homework questions?

Discussion

7. What does a probability tell us? What types of values are acceptable in which to answer if the question is "What is the probability that…?"

8. Determine if the following questions should be solved by using a normal distribution, binomial distribution, or an expected value.

a. It was found that 72% of Ohioans support Issue 7 on the upcoming ballot. Asking 10 Ohioans, what is the probability that at least 8 of them will say they support the issue?

b. It was found that 72% of Ohioans support Issue 7 on the upcoming ballot. Asking 10 Ohioans, how many would you expect to say that they support the issue?

c. If you asked 100 Ohioans about Issue 7, an average of 72 people would say they support it with a standard deviation of 2 people. Asking a random group of 100 people, what is the probability that between 68 and 71 people will say they support the issue?

9. Consider the data below from a local veterinarian which shows the frequency of the breed and weights of the owner's cats to answer the following questions.

Breed/Weight in lbs	$0 < x < 8$	$8 \leq x < 16$	$16 \leq x$	TOTAL
Persian	7	4	3	14
Savanah	1	3	5	9
Bengal	2	4	1	7
TOTAL	10	11	9	30

Picking a cat at random...

a. What is the probability that the cat is a Persian?

b. What are the odds the cat is a Persian?

c. What is the probability that the cat is a Savanah or between 8 and 16 pounds?

d. What is the probability that the cat is less than 16 pounds?

e. What is the probability that the cat is not a Bengal?

f. What are the odds the cat is not a Bengal?

g. What is the probability that the cat is a Bengal and at least 16 pounds?

h. What is the probability that the cat is a Bengal given that it's at least 16 pounds?

i. What is the probability that the cat is at least 16 pound given that it's a Bengal?

j. If the flea and tick medicine for a cat was based on weight where a cat less than 8 pounds needs $20 worth of medicine, a cat between 8 and 16 pounds needs $22.50 worth of medicine, and a cat that is at least 16 pounds needs $27 worth of medicine, what is the average cost of the Savanah cats?

10. Consider a bag of 20 marbles: 8 blue, 7 green, and 5 red. Picking 3 marbles one at a time without replacement, what is the probability that they are all green?

11. You and a friend go to a Mexican restaurant for lunch. Their menu offers 9 small dish entrees, and you can pick three of them. Assuming that you cannot have the same entrée more than once...
a. How many ways can you pick the entrees if the order in which they are picked is not important?

b. How many ways can your friend pick the entrees if the order in which they are picked is important?

c. Assuming the order doesn't matter, what is the probability that you both pick the same three entrees?

Worksheet # 25

Covering Section 4.1

Preview

1. Consider the illustration below showing the historical town Königsberg:

Notice there are three bridges that connect to the northern land area, there are five bridges that connect to the island in the west, there are three bridges that connect to the land to the east, and there are three bridges to the connect to the land area in the south. A simplified version of this illustration is shown below.

Exercise #1 continued

For convenience, use the simplified illustration below to answer the following questions.

a. Figure out why it's not possible to cross each bridge only once and return to where you started.

b. If you were a city planner and you wanted to make it possible, where could you put an extra bridge or bridges? Draw the corresponding picture.

c. If you couldn't add a bridge but could take away a bridge, which bridge or bridges would you take away to make the walk possible? Draw the corresponding picture.

2. Consider the illustrations below. Your challenge is to redraw the picture without lifting your writing utensil and without backtracking along a previously-used segment.

   a.

   ε C

   b.

   imp

   c.
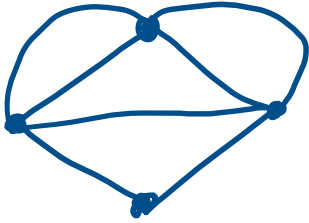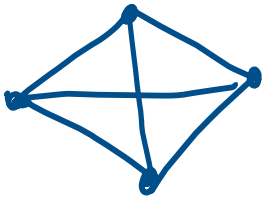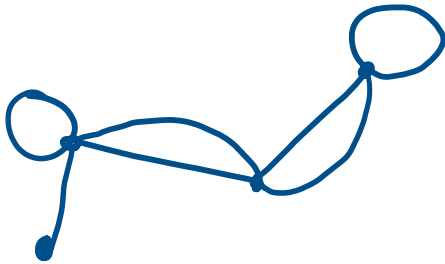
   ε P

3. Consider the map of continental Australia below showing its regions and their capital cities.
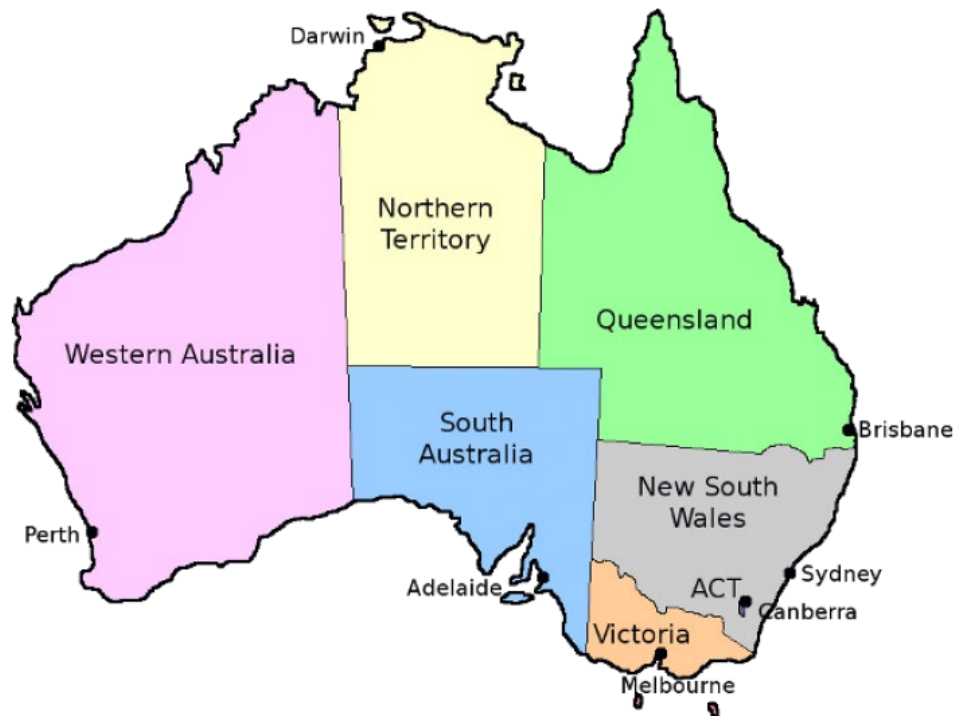
Redraw the map with the following properties:

- The capital cities are in the same geographic location as shown in the map above.
- The capital cities are connected to each other if the corresponding regions border each other
- Note that the capital of Australia is in its own region called ACT (Australia Capital Territory) similar to our Washington D.C.

"Don't worry about the world coming to an end today. It's already tomorrow in Australia."
-Charles Schulz

Worksheet # 26
Covering Section 4.2

Review

1. Define the following terms and give an example:
a. Graph

b. Vertex

c. Edge

d. Equivalent graphs

e. Adjacent vertices

f. Loop

g. Degree of a vertex

2. Draw an example of a graph that meets the following requirements:
a. Three even vertices and two odd vertices.

b. A graph with 3 vertices and one of the edges is a loop. The total degree is 10.

3. How many edges were drawn in **#2b**. What is the relationship between the total degree and the number of edges in a graph?

4. Consider the following graph to answer the following questions.
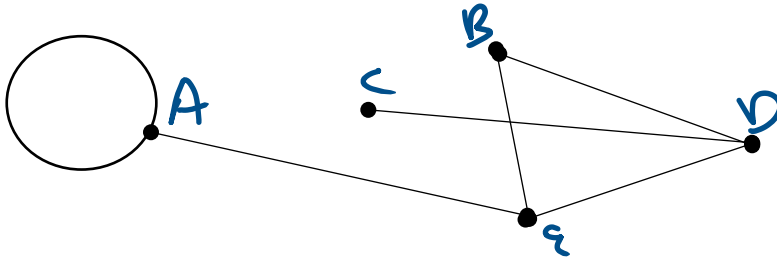
a. A student found the degrees of each vertex as follows. Do you agree?
   A: 2, B: 2, C: 1, D: 3, E: 3

b. Draw an example of an equivalent graph.
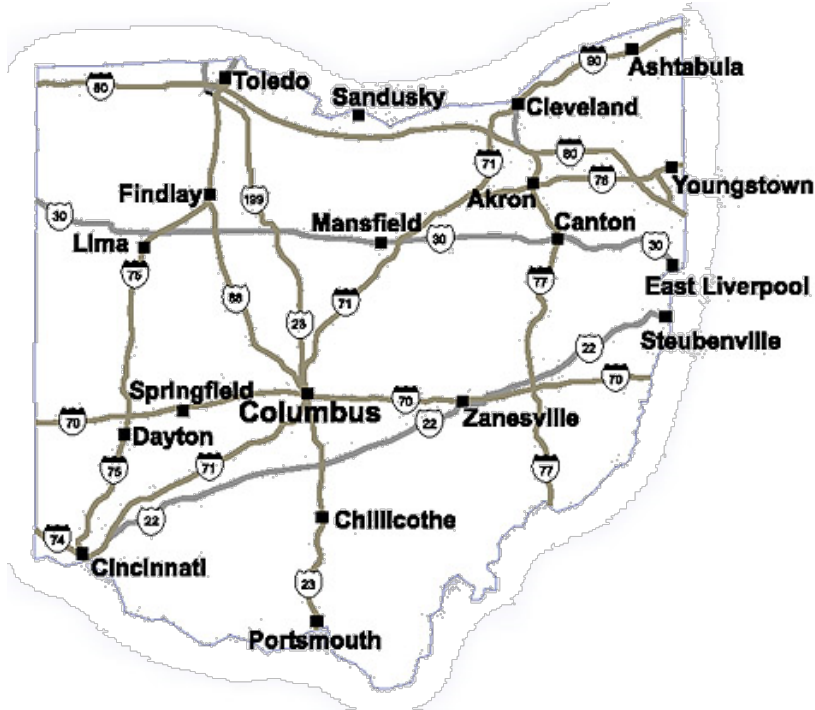
c. List the pairs of adjacent vertices.

5. Homework questions?

Discussion

6. What does the word "path" mean to you?

7. Considering the map of Ohio below to answer the following questions.

a. Suppose you lived in Cleveland and had a friend staying with you. You planned to visit parts of Ohio with them. You wanted to visit alpacas in Zanesville, visit COSI in Columbus, friend's house in Akron, a Reds game in Cincinnati. You plan to stay overnight in Akron so that should be the last destination. Describe the trip you'd take starting from Cleveland.
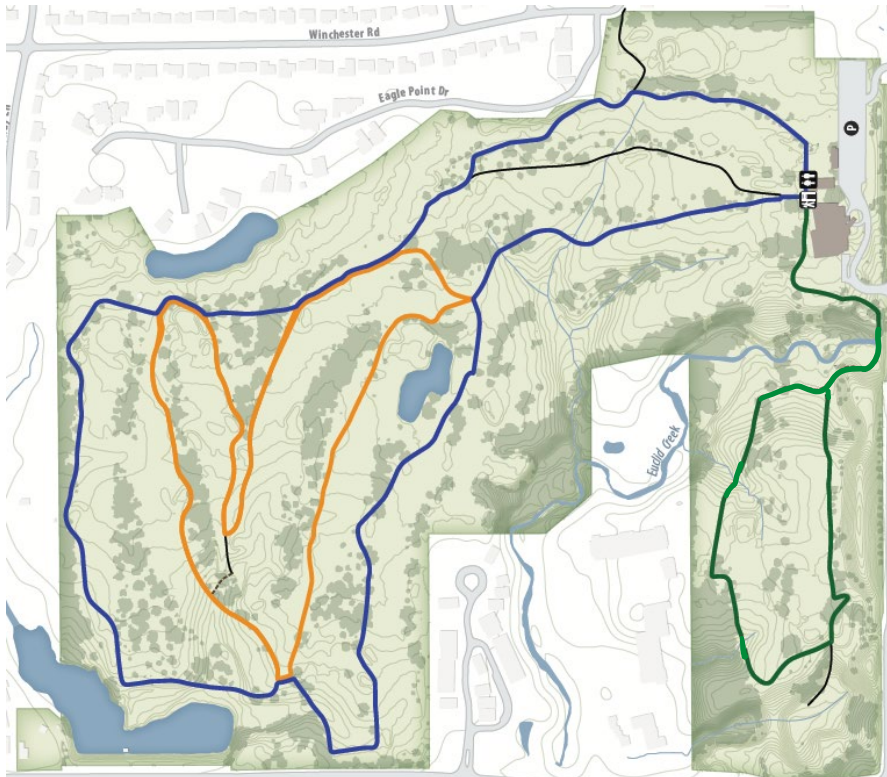
b. Compare your trip to your classmates. Did they use the same roads and visit destinations in the same order?

c. Using Google Maps or any other online map service, determine the total distance traveled on the trip you picked.

Activity

8. Below is a diagram of the trail system at the Cleveland Metropark Acacia Reservation:


Suppose you were starting your walk at the bathrooms (upper-right corner of the map).

a. What color trail could you take so that you would not have to retrace your steps and use the same portion of the trail more than once to return to the bathrooms?

b. What color trail could you take so that you would have to retrace your steps?

c. Are any trails considered loops?

Worksheet # 27

Covering Section 4.3

Review

1. Define the following terms and give an example:

a. Path

b. Circuit

c. Euler Path

d. Euler Circuit

e. Connected

f. Bridge

2. Draw an example of a graph that meets the following requirements or explain why it's not possible:

a. A graph that contains an Euler Path and every edge is a bridge.

b. A graph that contains an Euler Circuit and has two odd vertices.

3. Determine for the given graph if there is an Euler Path, Euler Circuit, or neither. Be sure to find the degree of each vertex.
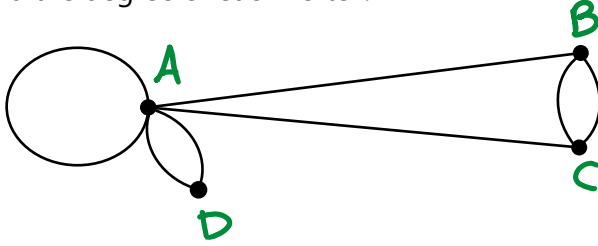
4. Homework questions?

 Discussion

5. For the graph in **3** can there also be an Euler Circuit? Why or why not?

6. Must a graph have an Euler Path or an Euler Circuit?

7. Fill in the blanks with the words "path", "circuit", "Euler Path", and "Euler Circuit".

A sequence of vertices and the edges connecting them where no edge is reused is called a _____. A _____ that starts and ends at the same vertex is called a _____. A _____ that uses all the edges is called an _____. A _____ that starts and ends at the same vertex and uses all the edges is called an _____. An _____ needs two odd degree vertices and must start at one of them and end at the other. An _____ cannot have any odd degree vertices in the graph.

8. Draw an example of a graph that has neither an Euler Path nor an Euler Circuit.

Activity

9. Pick three of the labeled cities below and find the distances between the cities using Google Maps or similar. Create a graph where there are three vertices and there is an edge between each pair of cities. Label the edges with the distances between the cities.

10. Consider the table below which shows the distances, in miles, between your home and various places in your town. You need to run some errands today and you'll be starting from and return to your home.

	Home	Library	Grocery Store	Discotheque
Home		1.2	2.7	5.8
Library	1.2		3.1	2.4
Grocery Store	2.7	3.1		6.3
Discotheque	5.8	2.4	6.3	

a. Create a graph with four vertices, one for each location, and an edge between each pair of vertices. Label each edge with the distance between each location.

b. Suppose you drove from your home to the discotheque, to the grocery store, to the library, and then back to home. How far did you travel?

c. Suppose you drove home to the grocery store, to the library, to the discotheque, and then back to home. How far did you travel?

d. Do you think there is a more efficient route to take to complete your errands?

⟳ Review

1. Define the following terms and give an example:

a. Hamilton Path

b. Hamilton Circuit

c. Complete graph

d. Weighted graph

2. For the weighted complete graph below, find the optimal Hamilton circuit starting and ending at vertex A using the Brute Force and Nearest Neighbor methods. Did you get the same answer?
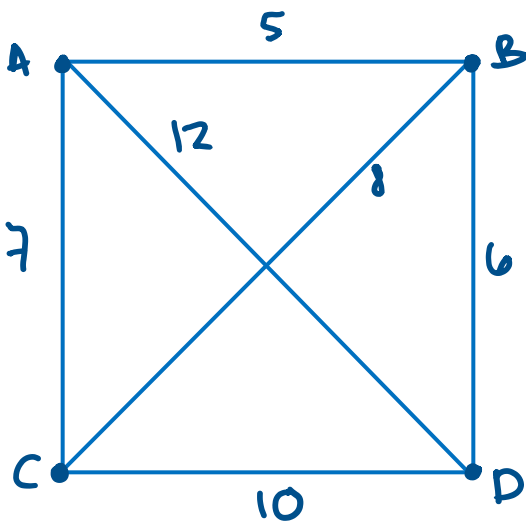
3. Homework questions?

Discussion

4. Compare and contrast Brute Force and Nearest Neighbor methods.

5. Choose the best term to describe the route in the situations below. You can choose from "path", "circuit", "Euler Path", "Euler Circuit", "Hamilton Path", and "Hamilton Circuit".
a. A semi-truck will start in Cleveland, Ohio and make several stops along the way until it finally reaches its destination in Joliet, Illinois.

b. At a ski resort, attendees can pick one of several trails to take based on number of years they have been skiing. The ski lift picks them up at the bottom of the hill and returns them to the top of the hill no matter which trail they pick.

c. You are at your friend's house and your mom wants you to come home and clean your room. In the hopes of stalling, you ride through all your town's streets on the way home.

d. For your gap year, you decide to visit all of the capital cities in the contiguous United States (lower 48 states) starting and ending in Columbus, Ohio.

6. For the following graph, select the best answer from the following list. Not all terms will be used.

    path   circuit   Euler Path   Euler Circuit   Hamilton Path   Hamilton Circuit
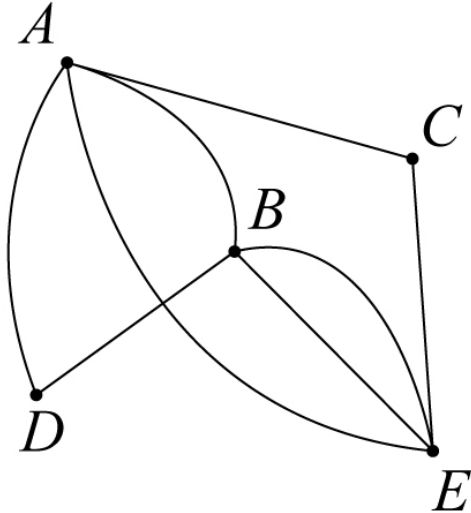
DBECAD _____

BEBACEADB _____

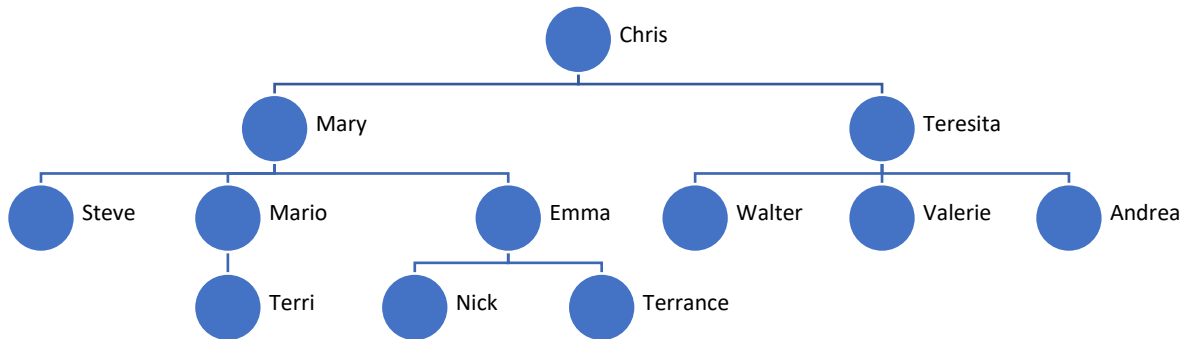*CEBAD* _____

CEBA _____

EBEACE _____

7. Explain why the term that wasn't used in **#6** wasn't possible for the given graph.

Activity

8. Consider the phone tree given below to answer the following questions.

a. Create and label an equivalent graph.

a. How many vertices are there? How many edges?

b. Mathematically speaking, every edge in the graph is also a _____.

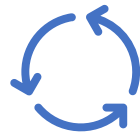c. If Chris needed to announce something, how would Terri find out that information?

d. Both Nick and Terrance didn't find out the necessary information, but Steve did. What does this imply?

"A FAMILY DOESN'T HAVE TO BE PERFECT, IT JUST HAS TO BE UNITED."

– ANONYMOUS

Worksheet # 29

Preparing for the test on Graph Theory

Review

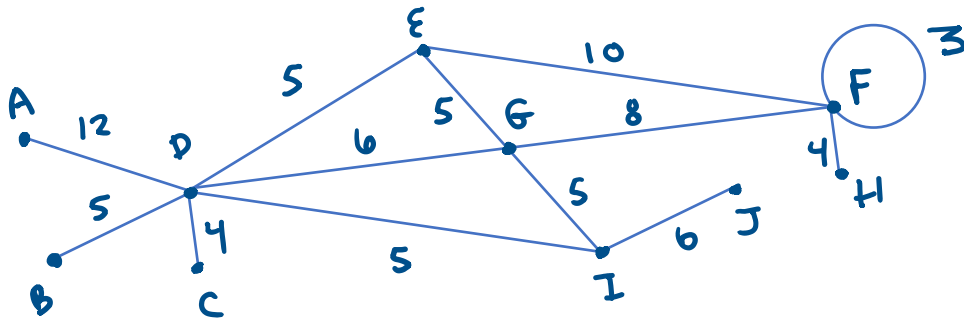1. Define the following terms and give an example:

a. Subgraph

b. Tree

c. Spanning Tree

d. Minimal Weight Spanning Tree

2. For the weighted graph below, find a minimal weight spanning tree.


3. Homework questions?

4. Compare and contrast the different types of paths and circuits.

5. Draw a graph that represents the given situation:
   Yum on the Go is a food delivery service. The drivers working right now are Bonnie and Clyde. Both arrive at the restaurant to pick up their deliveries. Bonnie needs to deliver to 4 households and Clyde needs to deliver to 3.

6. For the given graph, determine the degree of each vertex, the total degree of all of the vertices, and whether the graph contains an Euler Path or an Euler Circuit. If so, give an example of one.
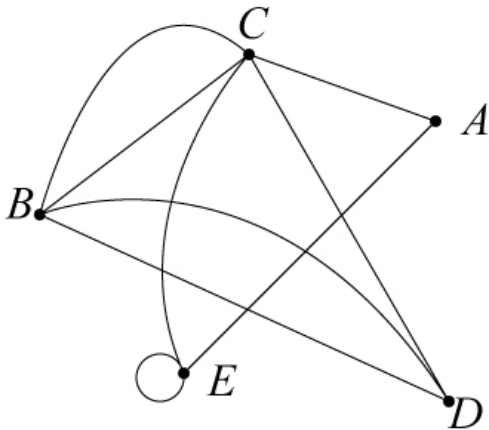
7. How many Hamilton Circuits would there be in a complete graph that has 6 vertices?

8. Consider the weighted graph below which shows the distances between the given places in miles to answer the following questions.
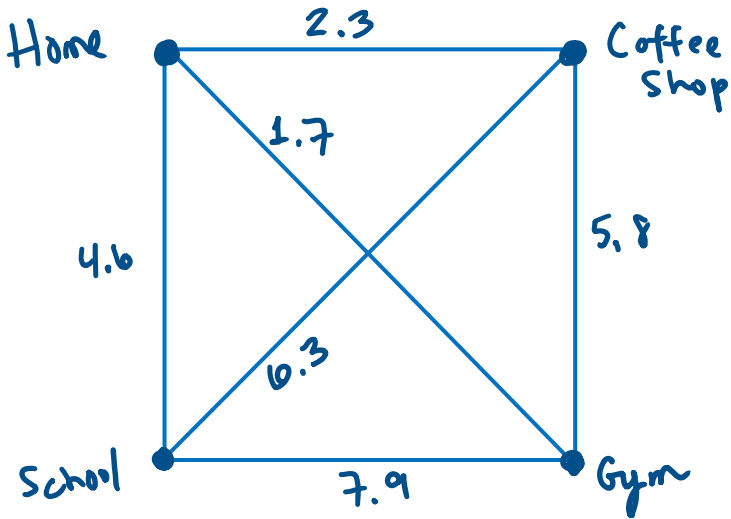
a. Complete the table below using the values from the weighted graph.

	Home	Coffee Shop	School	Gym
Home				
Coffee Shop				
School				
Gym				

b. Find the optimal Hamilton Circuit using both the Brute Force and Nearest Neighbor methods. Did you get the same answer?

9. Rework **#2** to find a maximum weight spanning tree.

10. Certain edges in **#2** and **#9** had to be used in both graphs. What type of edges were they?

    Also, there was an edge that had to be avoided. Which edge and why?

"The way I see it, if you want the rainbow, you gotta put up with the rain."
— Dolly Parton

Worksheet # 30

Covering Section 5.1

Preview

1. The words meter, mile, kilometer, inch, yard, centimeter, millimeter, and feet are all words used to talk about which type of measurement?

2. Organize the words in **#1** based on if they are in the English or the Metric system.

3. There are _____ inches in a foot and there are _____ feet in a yard. There are _____ feet in a mile.

4. There are _____ millimeters in a centimeter and there are _____ centimeters in a meter. A kilometer is _____ meters.

5. Use the terms "inch", "foot", "yard", "mile" to describe the best unit of measure for the following:
a. The length of a countertop

b. The width of your front yard

c. The distance from your home to the grocery store

d. The length of a classroom

e. The length of new hardware for a cabinet

f. The distance a football is thrown

6. Redo **#5** now using the words "millimeter", "centimeter", "meter", and "kilometer".

7. Organize the following values from greatest to least.
$$100x, \frac{1}{10}x, \frac{1}{1000}x, x, 1000x, 10x, \frac{1}{100}x$$

8. Simplify the following:

a. $14.58 \cdot 10$

b. $18.448 \cdot 100$

c. $7.42 \cdot 1000$

9. Referring to **#8**, how many times was the decimal moved and in which direction? What conclusion can you make?

10. Simplify the following:

a. $14.58 \cdot \frac{1}{10}$

b. $18.448 \cdot \frac{1}{100}$

c. $7.42 \cdot \frac{1}{1000}$

11. Referring to **#10**, how many times was the decimal moved and in which direction? What conclusion can you make?

12. Simplify the following fractions completely:

a. $\dfrac{4}{49} \cdot \dfrac{7}{40}$

b. $\dfrac{6a}{20b} \cdot \dfrac{30b}{12c}$

c. $5 \cdot \dfrac{2}{35}$

d. $12a \cdot \dfrac{1}{18a}$

e. $\dfrac{7a}{3b} \cdot \dfrac{14a}{5b}$

"Perseverance is not a long race. It is many short races, one after the other, so hang in there."

-Walter Elliot

Worksheet # 31

Covering Section 5.2

Review

1. Put the words meter, mile, kilometer, inch, yard, centimeter, millimeter, and feet in order from shortest unit of length to longest unit of length.

2. What does 3.72×10^5 mean? How about 1.988×10^{-3}?

3. Find and correct the error(s) in the following problems.
a. Convert 4.8 feet to inches.
$$\frac{4.8 \; ft}{1} \cdot \frac{1 \; ft}{12 \; in} = 0.4 \; in$$

b. Convert 8.944 cm to meters.
$$8.944 = 894.4 \; meters$$

c. Convert 1.04 kilometers to feet
$$\frac{1.04 \; km}{1} \cdot \frac{1 \; m}{1.609 \; km} \cdot \frac{1 \; mi}{5280 \; ft} = 0.000122 \; feet$$

4. In the 2022 Winter Olympics, Nils van der Poel skated in the 10,000 meters race in with an average rate of 47.95 km/h. Convert this rate into...

a. Miles per hour

b. Feet per second.

5. Homework questions?

Discussion

6. Referring to problem **2c**, did the given answer make sense for the problem? What red flags should you look for while performing dimensional analysis?

7. Explain how to use a unit fraction to convert between different units of measurement.

8. Explain how to use King Henry.

9. What is the difference between = and ≈? When is it appropriate to use each one?

10. What do you know already about area and volume?

Activity

11. Classify the following as a measurement of length, area, or volume.
a. The about of water that can fill a bathtub.

b. The amount of wrapping paper needed to cover a gift.

c. The number of corn kernels that can fit in a box.

d. The center of a wall to symmetrically align a TV.

e. The amount of paint cans needed to paint a house.

f. The amount of cutting a tailor needs to do to rehem jeans.

12. Find the following:

a. $4.82 \cdot 2.33$

b. $0.38 \cdot 9.44$

c. $10.84a \cdot 1.8a$

d. $5.5b \cdot 2.7b \cdot 1.8b$

e. $\dfrac{912a}{1} \cdot \dfrac{844b}{24a}$

f. $\dfrac{1.55a}{1} \cdot \dfrac{2.34c}{1.9b} \cdot \dfrac{9.88b}{1.17a}$

"Jag har misslyckats om och om igen i livet och det är därför jag lyckas."

- Anonym

Worksheet # 32

Covering Section 5.3

Review

1. When you multiply two same unit lengths together, it becomes an _____. When you multiply three same unit lengths together, it comes a _____.

2. Find and correct the error(s) in the following problems.
a. Find the area of a rectangle that is 10 cm by 8.5 cm.

   Answer: $10 \ cm \ \cdot 8.5 \ cm = 85 \ cm$

b. A locker poster measures 3.5 feet by 8 inches. Find the area of the poster.

   Answer: $3.5 \ ft \cdot 8 \ in = 28 \ ft^2$

c. Convert $1.85 \ yd^2$ to square inches.

   Answer: $\dfrac{1.85 \ yd^2}{1} \cdot \dfrac{27 \ ft^2}{1 \ yd^2} \cdot \dfrac{12 \ in^2}{1 \ ft^2} = 599.4 \ in^2$

d. Convert $2.35 \ km^2$ to m^2

   Answer: $2.35\underset{\sim}{0.} = 2,350 \ m^2$

e. The population of Peru is 34,294,231 people and the area is 496,225 square miles. Determine the population density of Peru. Round to four places.

   Answer: $\dfrac{496,225 \ miles}{34,294,231 \ people} = 0.0145 \ people \ per \ square \ mile$

3. Using the correct answer to **#2e**, determine the population density in people per square kilometer.

4. Consider an overhead view of a pool below which has the shape of a rectangle surrounded by two semicircles.

8 feet
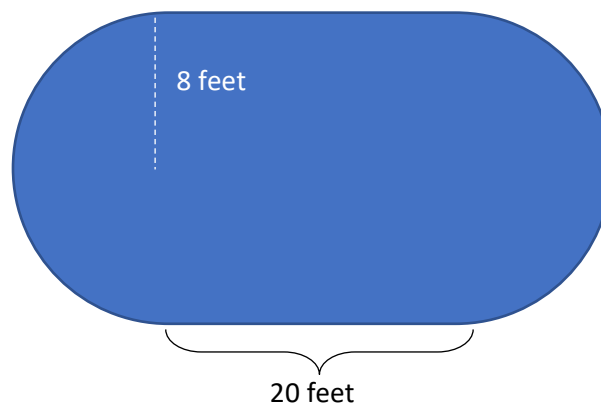
20 feet

a. Determine the surface area of the pool.

b. Given that the pool is 10 feet deep, determine the volume of the pool.

c. Given that approximately 7.48 gallons of water takes up 1 cubic foot, determine the number of gallons needed to fill the pool.

5. Homework questions?

Discussion

6. What is the difference between volume and capacity?

7. In the culinary arts, the region of the world you live in may affect how you cook. In America, we tend to use measuring cups while in other countries, they use a food scale. Discuss the pros and cons of each method of measurement.

8. In an internet search, determine the current value of a euro to the U. S. dollar. How can you use this value to determine how much something from Spain costs?

9. Which is stronger, the U. S. Dollar or the Euro? Which is stronger, the U. S. Dollar or the Canadian Dollar? How do you know?

10. Considering that you've now worked with both the English and Metric systems and their conversions and you know that only the U. S., Myanmar, and Liberia are the only countries to use the English system, would you want the U. S. to switch to the metric system? Why or why not?

11. What do you already know about Fahrenheit and Celsius?

12. What are the freezing and boiling points of water in Fahrenheit and Celsius?

Activity

13. Classify the following as a measurement of length, area, volume, or weight.
a. Measuring the amount of flour for a cake.

b. The amount of plastic wrap needed to cover leftover pizza.

c. The amount of potato chips in a bag.

d. The size of curtains you are buying for your kitchen window.

e. Tracking how much you've lost four months into a new workout program.

"Wherever you go, no matter what the weather, always bring your own sunshine."

–   Anthony J. D'Angelo

Worksheet # 33

Preparing for the test on Dimensional Analysis

Review

1. A margherita cake requires the following ingredients:

    Flour Type 00: 90 grams
    Sugar: 150 grams
    Eggs: 3
    Fine salt: 1 gram
    Butter: 90 grams
    Potato starch: 50 grams
    Baking powder: 3 grams
    Egg yolks: 3
    Lemon peel: 1

    a. Convert the items above in bold using the information below.

    1 cup flour = 120 grams
    1 cup butter = 113 grams
    1 cup sugar = 201 grams
    1 teaspoon salt = 6 grams
    1 teaspoon baking powder = 5 grams
    1 cup potato starch = 190 grams

    b. The recipe calls for the oven to be set at 190°C. What is this temperature in Fahrenheit?

    c. The pan needed is to be round with a diameter of 20 centimeters. What is this diameter in inches?

    d. Suppose you had a 9-inch pan available. Will this work for the recipe? What adjustments would you have to make?
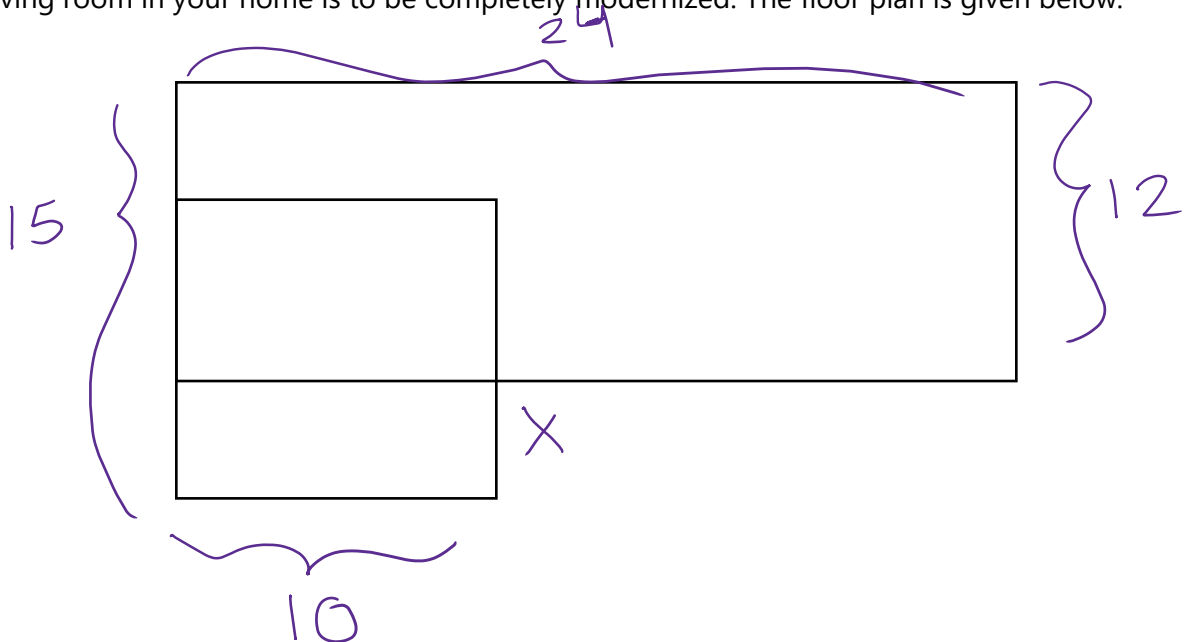
2. Homework questions?

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3. What is dimensional analysis? And why is it important?

4. What is purpose of a unit fraction and how is it used?

5. What are the common units of length in the English system? The Metric system?

For problems 6 - 10, refer to the following scenario.

A living room in your home is to be completely modernized. The floor plan is given below.

24

15

12

X

10

6. Determine the area of the flooring in square feet and in square meters.

7. You decide to import some azulejo tile from Portugal for the flooring. Each tile measures 15 cm by 15 cm. How many tiles are needed? If a box of tiles comes in packs of 50, how many packs are needed?

8. Each box of tiles costs 75.76€. If the current conversion is $1 = 1.09€, what is the cost in U. S. dollars?

9. Suppose the walls are 10 feet tall in the room. Each gallon bucket of paint covers 400 square feet. Excluding doors and windows and if two coats are required, how many buckets of paint are needed?

10. Each gallon bucket of paint costs $39.88. How much will be spent on the paint for the walls?

"All you need to paint is a few tools, a little instruction, and a vision in your mind."
– Bob Ross