Unit 3: Day 1: The Golden Ratio

Minds On: 5 Action: 50 Consolidate:20 Total=75 min	**Learning Goal**: • Calculate, interpret and apply measures of central tendency.	**Materials** • 10 - 12 Tape Measures • BLM 3.1.1 to 3.1.2 • Graphing calculators

			Assessment Opportunities
Minds On…	**Whole Class → Discussion** Lead students in a brainstorming session to discuss what it means to be "average". What does it mean to be above or below average? **Whole Class → Introduction to Activity** Students collect the measurements listed in BLM 3.1.1.		Students make connections between terms, concepts and principles of central tendency.
Action!	**Whole Class → The Golden Ratio** Using BLM 3.1.1, students collect individual data and generate class data for the four different ratios. The students calculate measurements of central tendency using technology (TI-83, Fathom 2, Excel) and record the class results in Table 3.1.1a. The students stop when the table has been completed and wait for further instructions from the teacher. **Small Groups → Discussion (Home)** Arrange the students in ascending order of L1 ratio. Distribute mean, median, mode, minimum, Q_1, Q_3, and maximum cards to the appropriate students. Break the students into four groups using the quartiles: each quartile group is assigned one of the four ratios for analysis. **Small Groups → Discussion (Expert)** Using numbered heads, break the home groups into smaller expert groups (include representation from each home group) and have the students complete the expert group question. **Process Expectations/Communicating/Observation:** Observe groups as they connect their results to the measures of central tendency. Listen to discussions and ideas looking for items that students can share with others during the Consolidate Debrief.		The mean card can be held by the student whose value is closest to the calculated mean.
Consolidate Debrief	**Whole Class → Discussion** Discuss results of the expert question with the whole class, highlighting the differences between the measures of central tendency. Include a description of quartiles, standard deviation and variance.		The Golden Ratio is approximately 1.61803399. Discuss with students how this number relates to the results.
Exploration Application	**Home Activity or Further Classroom Consolidation** Which measure would you prefer for your grade – mean, median, or mode? Why?		

3.1.1: The Golden Ratio

Perform the following measurements, standing straight up, with your arms at your sides and relaxed:

A. Your height, shoes off!
B. Top of your head to your finger tips
C. Top of your head to your elbows
D. Top of your head to the inside top of your arms
E. Your elbow to your fingertips

Now calculate your individual ratios, correct to two decimal places:

1. L1 = A / B
2. L2 = B / C
3. L3 = C / D
4. L4 = C / E

Record your L1, L2, L3, L4 ratios on the chalkboard under the appropriate column. Copy the class data set into the table below.

Table 3.1.1a - Student Results

L1	L2	L3	L4

3.1.1: The Golden Ratio (Continued)

Complete the table below for each of the measures, correct to two decimal places.

Table 3.1.1b – Measures of Central Tendency				
	L1	**L2**	**L3**	**L4**
Mean				
Median				
Mode				
Minimum				
Q_1				
Q_3				
Maximum				
Variance				
Standard Deviation				

Once you have completed the chart, wait for further instructions from your teacher.

Home Group: Within your assigned group, discuss answers to the following questions.

1) Consider the data set for your assigned ratio (L1, L2, L3 or L4). Which measurement (mean, median or mode) "best represents" this data? Why?

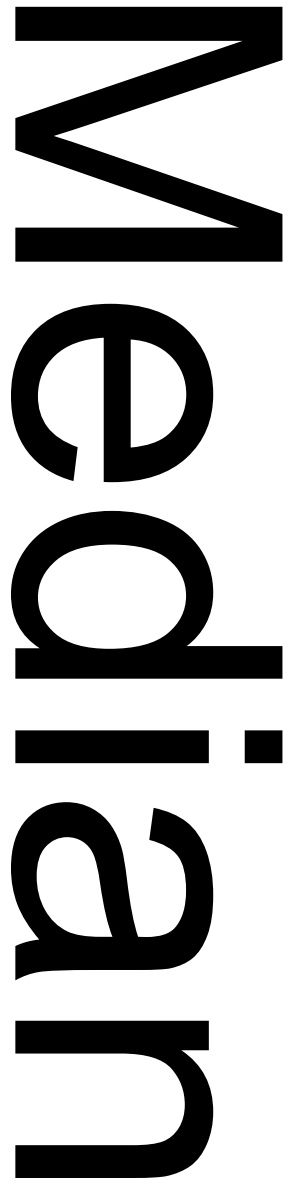
2) Which measurement "least represents" this data? Why?

Expert Group: Within your assigned group, determine the "best overall" measure of central tendency.

3.1.2: Measures of Central Tendency Cards

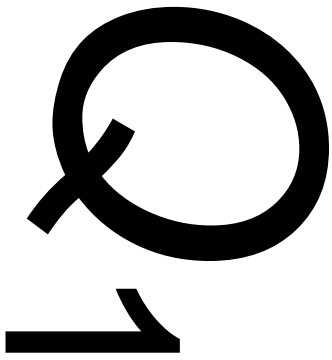
Mean

3.1.2: Measures of Central Tendency Cards (continued)

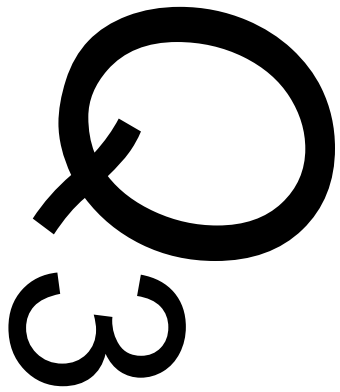


Mode

3.1.2: Measures of Central Tendency Cards (continued)

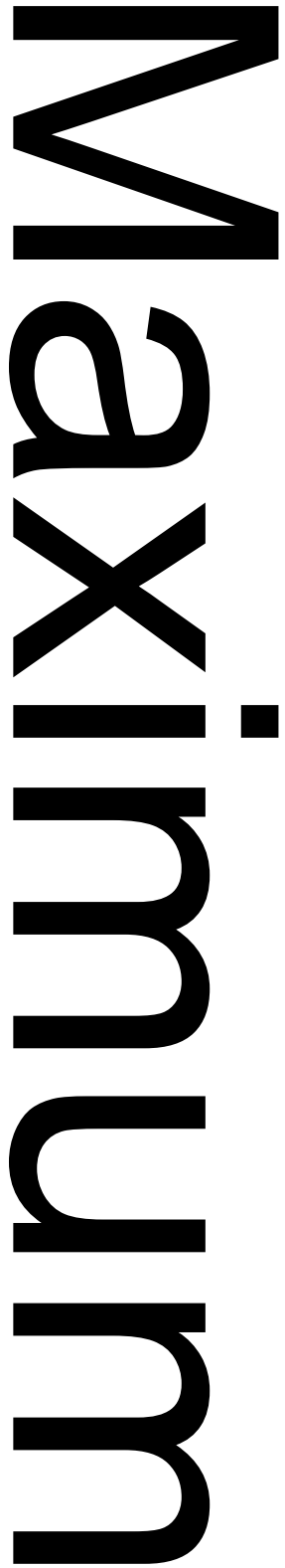


3.1.2: Measures of Central Tendency Cards (continued)



3.1.2: Measures of Central Tendency Cards (continued)

Minimum


Maximum

Unit 3: Day 2: On Target

Minds On: 5 Action: 50 Consolidate:20 Total=75 min	**Learning Goal**: • Calculate, interpret and apply standard deviation as a measure of central tendency.	**Materials** • BLM 3.2.1 to 3.2.4 • Timer • Graphing calculators • Masking Tape • Integer chips or flat discs

				Assessment Opportunities
	Minds On…	**Small Groups → Pass the Paper** Students each start with a paper and a title of "mean", "median" or "mode" in groups of three. Allow 1 minute for students write down what they know about the term, limitations and examples. After 1 minute, instruct students to pass their paper to the person beside them and continue in this way for three turns. After activity is completed, students engage in a discussion regarding the limitations of mean, median and mode as measures of central tendency. That is, they provide a central value, but do not indicate the spread and consistency of the data.		Students make connections between consistency and standard deviation.
	Action!	**Whole Class → Hitting the Mark!** Using BLM 3.2.1, students collect individual scores for three trials of the game. **Whole Class → Discussion** With reference to BLM 3.2.2, lead students in a discussion on the difference between precision and accuracy. Comment on the connection between precision and consistency and how these terms relate to standard deviation. **Process Expectations/Observation/Checklist** Observe groups as they develop their understanding of consistency as a measure of dispersion. Listen to discussions and ideas looking for connections to the next activity, BLM 3.2.3. **Whole Class → All Charged Up!** Students complete the performance task BLM 3.2.3. **Process Expectations/Performance Task/Rubric** Assess the students on the All Charged Up activity using BLM 3.2.4.		
	Consolidate Debrief	**Whole Class → Discussion** Lead students in a discussion on the interplay of precision, accuracy, consistency and standard deviation.		
	Exploration Application	**Home Activity or Further Classroom Consolidation** Think of a situation from everyday life. In this situation, is it better to have high accuracy or high precision? Can you think of a situation in which low precision (or low accuracy) would be acceptable?		

3.2.1: Hitting the Mark (Scoring Sheet)

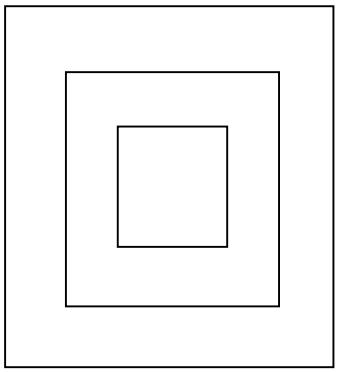
Student Name: _____

Scoring Instructions:
Keep a tally chart of your partner's performance below to calculate their total score.

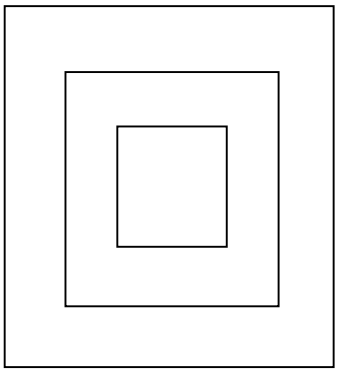
Points	Trial 1	Trial 2	Trial 3
10			
5			
1			
0			
Total			

For each toss, record the spot where the marker lands on the targets below

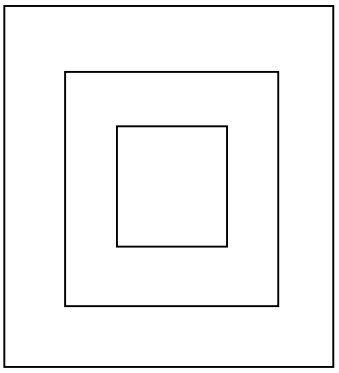
Trial #1



Trial #2



Trial #3

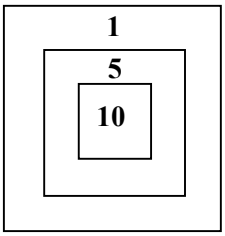


With reference to the grouping of your markers, how did your results change?

3.2.2: Hitting the Mark (Teacher Instructions)

Game Setup: Construct a game board on the floor with masking tape. Use the following dimensions:

Outer square:	150 cm by 150 cm
Middle square:	100 cm by 100 cm
Inner square:	50 cm by 50 cm



Add a starting line that is 2 m away from the outer edge of the target. With the addition of extra starting lines arranged around the target, up to four students can play at once.

Point values: Outer Square (1 point); Middle Square (5 points); Inner Square (10 points); outside of the target area scores no points.

Playing the game: students approach the starting line, and toss each of their 5 markers (integer chips, coins, coloured tiles) into the target area one at a time. A partner records where the chips land on the provided scoring sheet. Each player tries the game three times.

Recording: students record their results on the sheet provided (BLM 3.2.1) in both a table and a diagram.

Observations: Use the target analogy to lead a discussion regarding the class results on "Hitting the Mark". Comment on the connection between precision and consistency and how these terms relate to standard deviation.

High precision, but low accuracy

High accuracy, but low precision

3.2.3: All Charged Up!

You have been hired by LowTech Enterprises, a company that manufactures portable MP3 players, to choose a battery supplier. LowTech offers a warranty program that guarantees 200 recharges of their players; that is, LowTech will repair or replace any MP3 player that does not recharge 200 times.

The original supplier of the battery was supplier X. Their competition, Supplier Y, wants to be the new exclusive battery supplier for LowTech. You choose a random sample of twenty batteries from each supplier and experimentally determine the number of recharges for each battery.

The data from your experiment is as follows (the number given is how many times each battery was capable of being recharged):

Supplier X:
254, 259, 256, 253, 252, 250, 250, 249, 256, 254,
250, 251, 250, 248, 248, 254, 258, 255, 258, 255

Supplier Y:
257, 306, 179, 245, 192, 164, 325, 283, 289, 293,
287, 305, 155, 267, 331, 192, 265, 279, 312, 274

X claims that their batteries will last for an average of 253 recharges, while Y claims that their batteries will last for an average of 260 recharges. Which battery supplier would you recommend? Justify your choice by considering appropriate measures of central tendency.

3.2.4: All Charged Up! Rubric

Reasoning and Proving				
Criteria	Level 1	Level 2	Level 3	Level 4
Making inferences, conclusions and justifications	Justification of the answer presented has a limited connection to the problem solving process and models presented	Justification of the answer presented has some connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented, with evidence of reflection

Connecting				
Criteria	Level 1	Level 2	Level 3	Level 4
Making connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

Unit 3: Day 3: Graph It!

Minds On: 5 Action: 55 Consolidate:15 Total=75 min	**Learning Goal**: • Generate a graphical summary (box and whisker plot, histogram) of a one variable data set.	**Materials** • BLM 3.3.1 to 3.3.3 • Rulers • Technology (Fathom 2, Excel, TI-83)

			Assessment Opportunities
Minds On…	**Pairs → Picture Perfect** Student work in pairs and discuss the questions in BLM 3.3.1 regarding the graphical representation of data. Why is it important to represent data in a graphical format?		
Action!	**Whole Class → Reaching New Heights** Using BLM 3.3.2, students generate a box and whisker plot and a histogram for a given data set. **Small Groups → Discussion** With reference to BLM 3.3.2, students discuss their response to the last question regarding which representation (box and whisker or histogram) "best" represents this data set. **Process Expectations/Communicating/Observation:** Observe groups as they develop their understanding of graphical representations of data. Listen to discussions and ideas looking for connections to the next activity, BLM 3.3.2. **Whole Class → Between Friends!** If available, students use technology (Fathom 2, Excel, TI-83) to complete Between Friends (BLM 3.3.3). **Process Expectations/Representing/Observation:** Observe students as they generate graphical representations of data; check the box and whisker plots and histograms for accuracy and completeness.		If technology is not available, the students generate the representations by hand.
Consolidate Debrief	**Whole Class → Discussion** Lead students in a discussion on the challenges of graphical representations of data (how are scales chosen, what representations are most appropriate).		
Skill Development	**Home Activity or Further Classroom Consolidation** Describe how a histogram can be converted into a box and whisker plot. Is it possible to convert a box and whisker plot to a histogram? Why?		

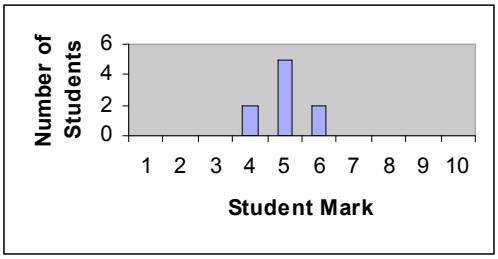
3.3.1: Picture Perfect

1. Which has more variability – A or B? Why?

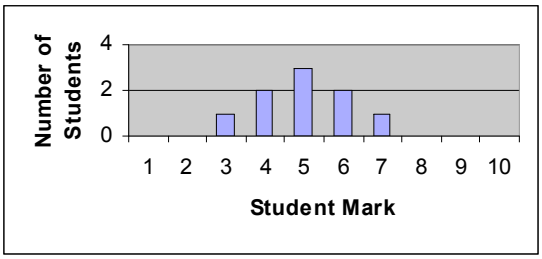
Graph A

Graph B

2. Which class did better? How do you know?



Blue Class



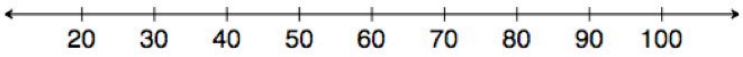
Yellow Class

3. Are there the same number of raisins in each box? How can you tell?

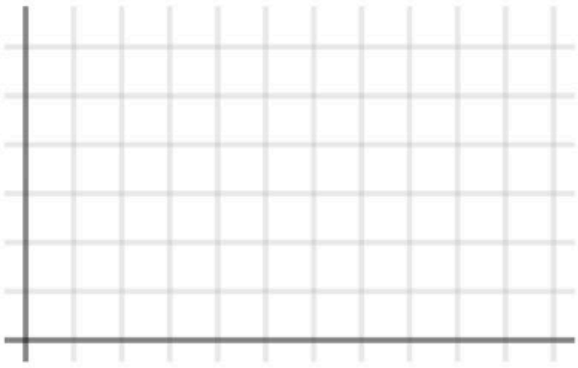
3.3.2: Reaching New Heights

4. The following are jump heights (in cm) from eleven different cats. Illustrate the data with a box and whisker plot using the number line below.

72, 40, 95, 58, 62, 35, 56, 65, 74, 68, 90



5. Determine appropriate intervals and represent the jumping heights in a histogram. Properly label your axes and provide a title.



6. Which tool is the better graphical representation of the data? Why?

3.3.3: Between Friends

Pick **one** of the questions below and survey your classmates.

- What is your birth month by number (January = 1, February = 2, …)?
- What is the last digit of your phone number?
- How many hours of television did you watch last week?
- How many books have you read this year?
- How many letters are in your last name?

Record the responses below.

_____

_____

_____

Prepare a box and whisker plot of your data. Be sure to indicate the scale and label the important data points (minimum, Q_1, median, Q_3, maximum).

Determine apropriate intervals and represent your data in a histogram. Properly label your axes and provide a title.

Unit 3: Day 4: Dazed by Data

Minds On: 10 Action: 25 Consolidate:40 Total=75 min	**Learning Goal**: • Explore different types of data (numerical, categorical - ordinal, nominal, interval, continuous, discrete) • Establish the attributes that information must have to be meaningful.	**Materials** • BLM 3.4.1 to 3.4.5 • Acetates • Overhead projector

				Assessment Opportunities
	Minds On…	**Pairs → Data in the Real World** Pairs choose one of the occupations suggested on BLM 3.4.1. Students interview each other about the kinds of data used in their work. Students discuss the data in terms of the two attributes that information must have to be meaningful: *numerical data* (the number or scalar) and *categorical data* (the labels or units telling us what the numbers are measuring). In a 2-Dimensional graph which axis is usually numerical and which is usually categorical? Think of a 2-D graph where both axes are numerical. How much information does it convey?		Example: 7314 7314 Km 7314 Km from Victoria, B.C. to St. John's, Nfld. **Answers:** Line graph: Horizontal axis must be categorical. Histogram: Either horizontal or vertical axis can be categorical. Scatter Plot: Both axes are numerical.
	Action!	**Whole Class → On The Road Again** Using BLM 3.4.2, students attempt to establish a relationship between data points provided on a graph without numerical or categorical descriptors. **Small Groups → Discussion** With reference to BLM 3.4.2, students discuss their response to the three questions. **Process Expectations/Communicating/Observation:** Observe groups as they develop their understanding of graphical representations of data. **Whole Class → On The Road Again** Using BLM 3.4.2 (Hints) provide a hint to the students. **Whole Class → Discussion** Using BLM 3.4.2 (Teacher Notes) present the solution to the students. Students engage in a discussion of the three questions asked. Using BLM 3.4.3 on acetate show the overlay naming the capital cities.		
	Consolidate Debrief	**Small Groups → What's My Word?** Students engage in a discussion on the challenges of data representation. Students create word association cards to help distinguish between *continuous* data and *discrete* data and the three types of categorical scales: *nominal, ordinal* and *interval*. Students use BLM 3.4.4 as a guide to the activity if word association cards have not been created before. **Process Expectations/Communicating/Observation:** Circulate and assess for understanding making mental notes of incomplete or incorrect illustrations and definitions.		
Practice		**Home Activity or Further Classroom Consolidation** Complete BLM 3.4.4. Classify the graphs on BLM 3.4.5 according to data type..		

3.4.1: Data in the Real World

Choose an occupation. Interview your partner with the questions provided. Discuss the types of data you use in your line of work and sort them into numerical or categorical data sets.

	Environment	Public Sector	Sciences and Engineering	Business	Transportation
Occupations	Meteorologist	Policeman	Forensic Scientist Architect Chemical Engineer	Accountant Stockbroker	Air Traffic Controller

Interview Questions:

What do you find challenging in your job?

What kinds of data do you use in your work?

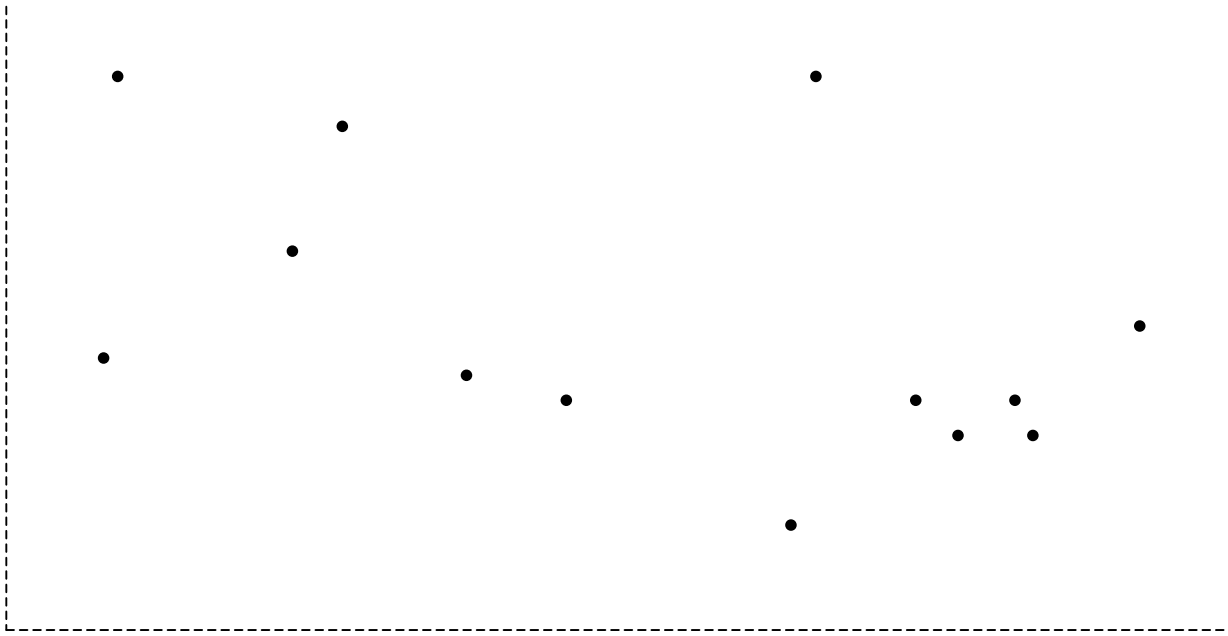
How is the data collected?

What types of tools do you use to work with the data?

Numerical Data	Categorical Data

3.4.2: On The Road Again

Working in groups of three, determine a possible pattern or relationship between the data points that would account for the scatter plot shown below.



Within your assigned groups, discuss answers to the following questions:

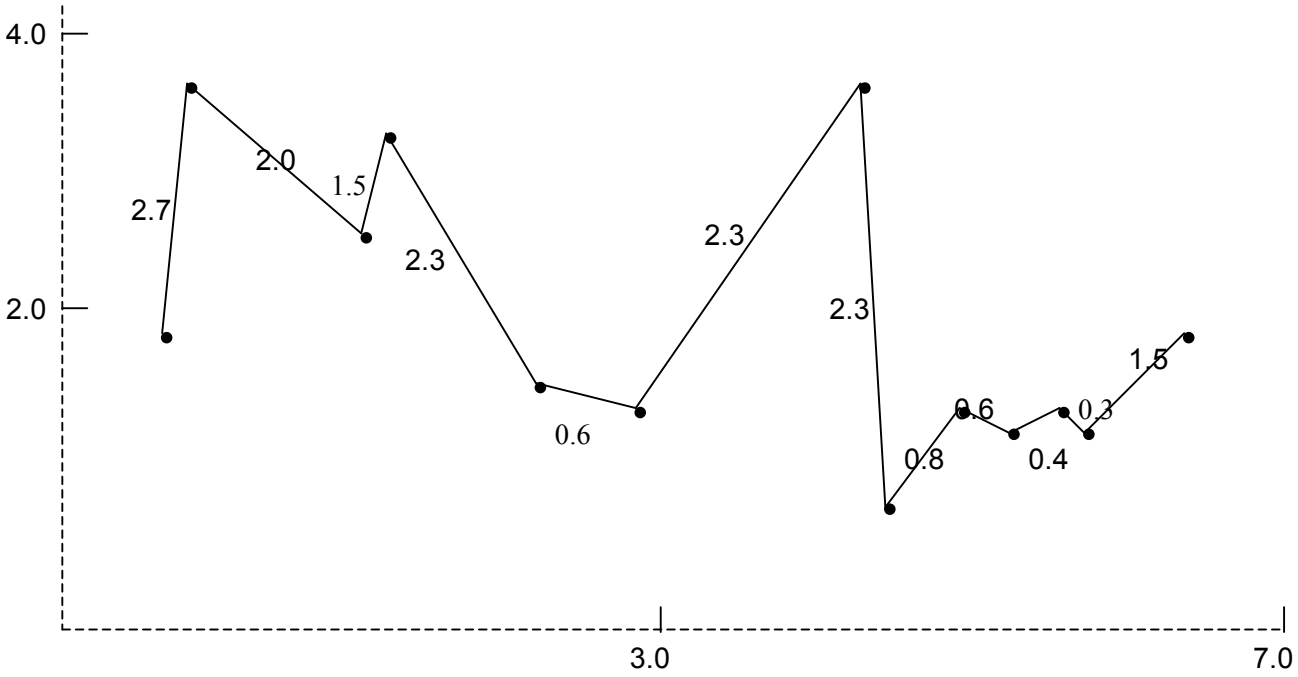
1) Without a scale, how much information is this scatter plot conveying?

2) What possible types of relationships could these data points have?

3) Is it necessary to have a predetermined scale to establish a relationship, assuming the dots are placed according to some representative scale?

3.4.2: On The Road Again (Hints)

Hint: Scale factors have been added and the scatter plot has been turned into a line graph. Does this help you establish a relationship between the data points? Has categorical data been added yet?



3.4.2: On The Road Again (Teacher Notes)

Does this map overlay help you establish a relationship? The dots represent Canada's provincial and territorial capital cities and the scale factors are the distance (in thousands of kilometres) between the cities.

Whole Class Discussion:

What was the categorical data that was added? How did it very quickly allow you to establish a relationship between the data points? Can you name the city that each dot represents?

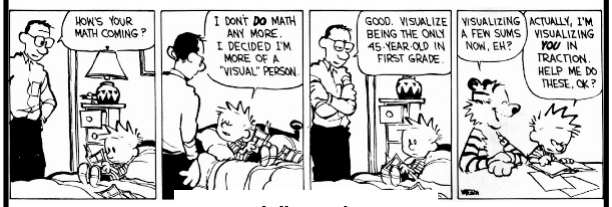
3.4.3: On The Road Again (Supplemental)

3.4.4: What's My Word?

Create Word Association cards to help you remember the vocabulary terms that you learned in today's lesson.

On each card, draw a rectangle divided into 4 sections. Each section of the card is labelled below. The term is written in the first section. The remaining sections include a visual representation, a definition written in your own words, and a personal association that will help you remember the term.

The vocabulary term can be written on the back of the card and used in a word wall.

<table>
<tr>
<td> 
Vocabulary Term</td>
<td> 
Visual Representation</td>
</tr>
<tr>
<td> 
In your own words…</td>
<td>Personal Association
  </td>
</tr>
</table>

3.4.4: What's My Word? (continued)

Verbal and Visual Word Association

- Print template on card stock.
- Print the vocabulary word on the reverse side then place the card on a word wall for future reference.

CONTINUOUS DATA	

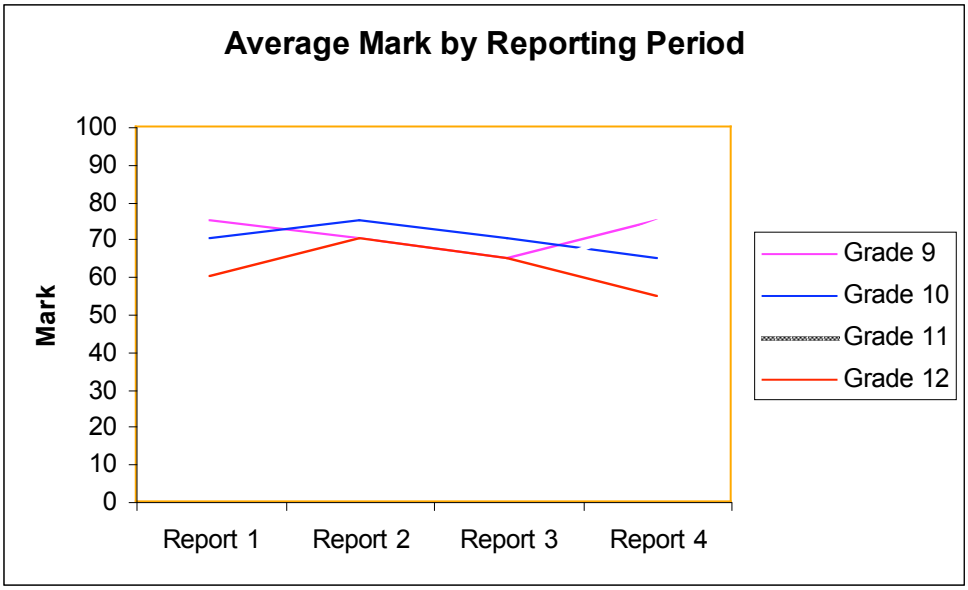
DISCRETE DATA	

NOMINAL SCALE	

ORDINAL SCALE	

INTERVAL DATA	

3.4.5: Identifying Numerical and Categorical Scales



The above graph shows the average marks for Grades 9 through 12 by reporting period.

Questions:

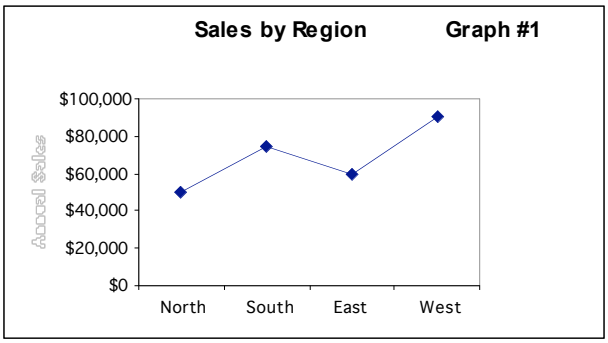
1) Identify the categorical scale and the numerical scale.

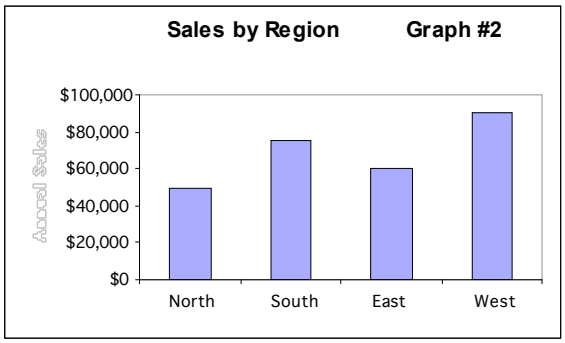
2) How much useful information would be provided if either the categorical or numerical scale where missing?

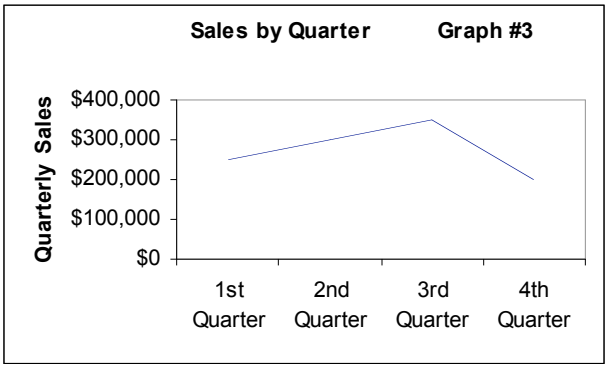
3) Mathematically, does it make sense to connect the data points by a line? Why or why not?

3.4.6: Classifying Categorical Scales

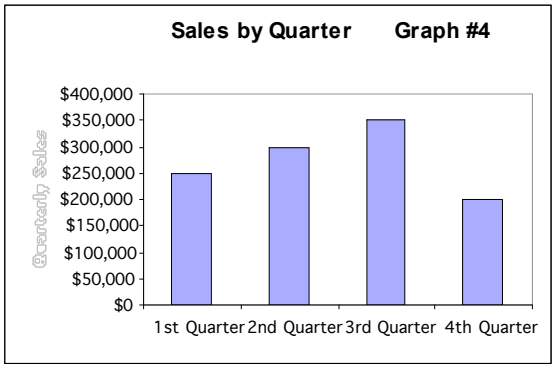
For each graph below indicate the type of categorical scale and whether the graph is appropriate (i.e. should lines be used or is a histogram more appropriate?)



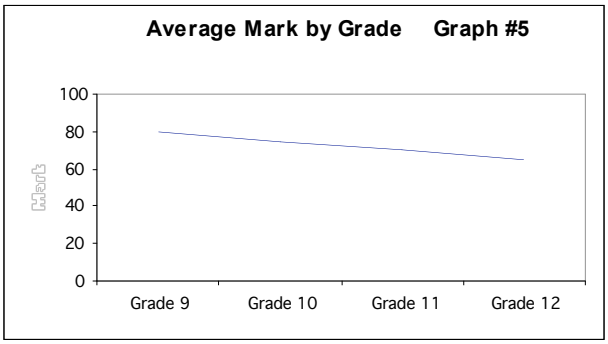




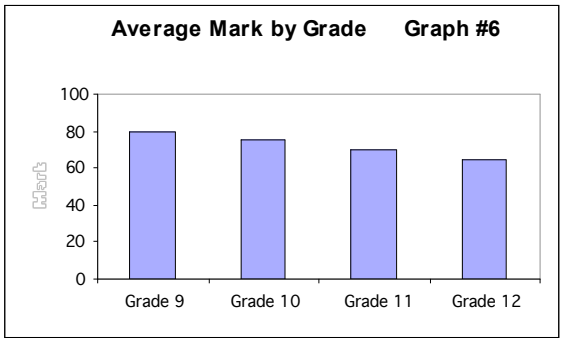
ANALYSIS:



ANALYSIS:

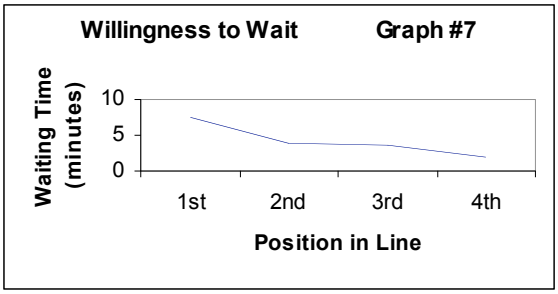


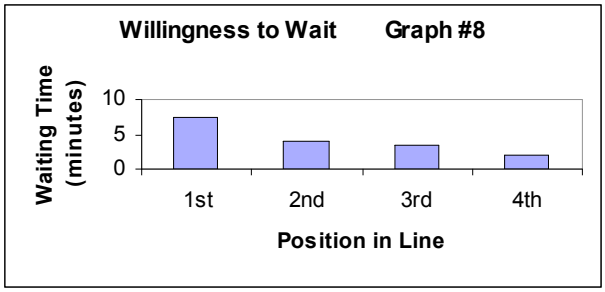
ANALYSIS:



ANALYSIS:

3.4.6: Classifying Categorical Scales (Continued)



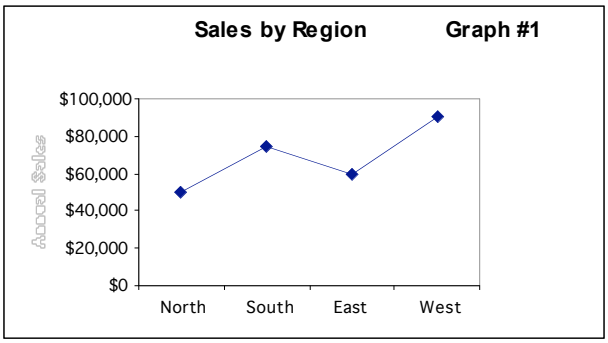


Overview:

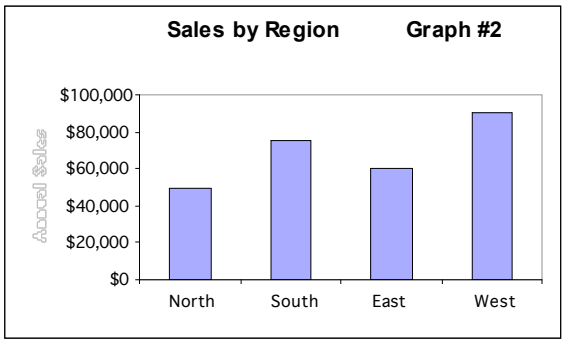
Lines in a graph suggest **trends** and **patterns** in the data. Change is implied as you move from one item to the next. If the data points are not closely related through a continuous range of values, then the points cannot be connected by a line. Line graphs should only be used to link data points along an interval scale. Units of time (seconds, minutes, hours, days, weeks, months, years, etc.) are the most common interval scales. Line graphs or histograms can always be used with time as a categorical scale. If you wish to emphasize the shape or change in the data, then line graphs are the most appropriate. If you wish to emphasize individual items, then histograms can be most effective.

3.4.6: Classifying Categorical Scales (Teacher Notes)

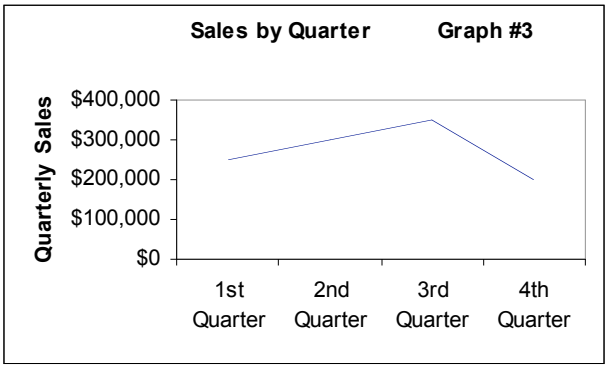
For each graph below indicate the type of categorical scale and whether the graph is appropriate (i.e. should lines be used or is a histogram more appropriate?)



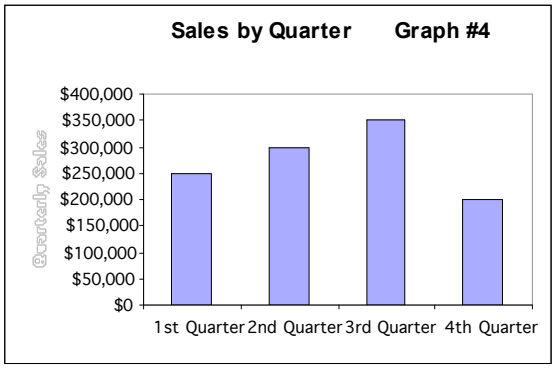
ANALYSIS: Nominal categorical scale.
Line graph inappropriate.



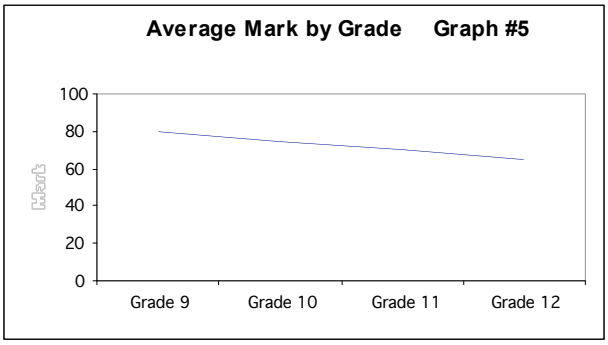
ANALYSIS: Nominal categorical scale.
Histogram appropriately used.



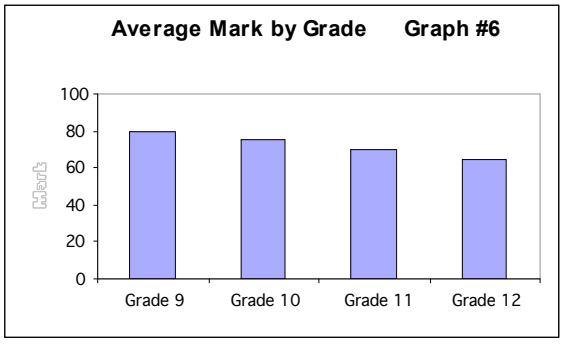
ANALYSIS: Interval categorical scale
Line graph appropriately used.



ANALYSIS: Interval categorical scale.
Histogram appropriately used.

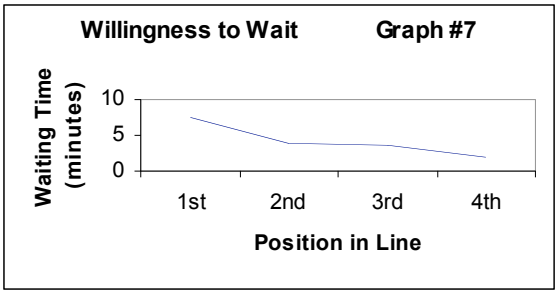


ANALYSIS: Interval categorical scale.
Line graph appropriately used. Each grade represents an equal interval of time.

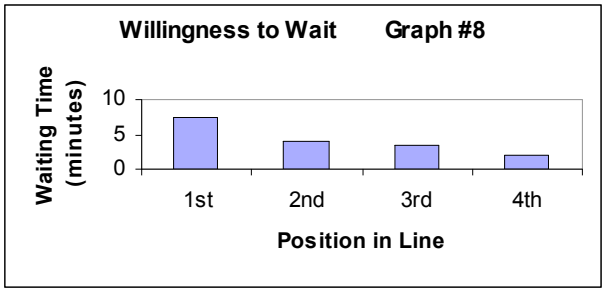


ANALYSIS: Interval categorical scale.
Histogram appropriately used. With interval scales, you may use line graphs or histograms.

3.4.6: Classifying Categorical Scales – (Teacher Notes) (continued)



ANALYSIS: Ordinal scale.
Line graph inappropriate



ANALYSIS: Ordinal scale.
Histogram appropriate

Unit 3: Day 6: Tennis Anyone? (Part 1)

Minds On: 10 Action: 55 Consolidate:10 Total=75 min	**Learning Goal**: • Generate a graphical summary (box and whisker plot, histogram) of a one variable data set. • Calculate measures of central tendency for a one-variable data set.	**Materials** • BLM 3.6.1 • Technology (Fathom 2, Excel, TI-83)

				Assessment Opportunities
	Minds On…	**Whole Class → Discussion** Students engage in a discussion regarding "the prime of your life". When does an athlete peak? Is the prime age for athletic activity different for men and women? What data would you need to respond to this question?		Use the Wimbledon Data Set, attached in BLM 3.6.1.
	Action!	**Small Groups → Tennis Anyone?** Students get into groups of four. Each member takes one of the data sets and performs statistical analysis using the tools learned so far (mean, median, mode, standard deviation, graphical representations) to determine the prime age of a tennis champion. **Process Expectations/Observation/Mental Note** Observe students' communication skills as they discuss the statistical analysis necessary to answer the question. Check that the students have an accurate understanding of measures of central tendency.		In the data sets, the ages of the doubles champions are both given – students will have to decide if using the average age of the team is appropriate.
	Consolidate Debrief	**Whole Class → Discussion** Student engage in a discussion regarding any obstacles faced and how they were overcome. **Process Expectations/Observation/Checklist** Observe students' communication skills as they discuss what aspects of the analysis were difficult.		
	Reflection	**Home Activity or Further Classroom Consolidation** In your journal, complete the sentence "In my group, my role is to…"		

3.6.1: Tennis Anyone?

Question: Do men and women reach their "athletic prime" at different ages?

One of the most prestigious tennis tournaments in the world is The Championships, Wimbledon, held every summer at the All England Lawn Tennis and Croquet Club in London, England. Each member of your group is being assigned one data set from this tournament that lists champions from Wimbledon since 1968. In the spaces below, record which group member is responsible for each data set.

Womens Singles: _____ Mens Singles: _____

Womens Doubles: _____ Mens Doubles: _____

Plan: What statistical measures and graphical representations will assist you in answering the question? Decide as a group how you will analyse the data sets (what tools will be used) and how your findings will be reported back to the group. Summarize your plan in the space below.

3.6.1: Tennis Anyone? (continued)

Womens Singles Champions, Wimbledon, 1968 to present

Year	Womens Champion	Age
1968	Billie Jean King	24
1969	Billie Jean King	25
1970	Billie Jean King	26
1971	Ann Haydon-Jones	32
1972	Margaret Smith Court	29
1973	Evonne Goolagong	21
1974	Billie Jean King	30
1975	Billie Jean King	31
1976	Chris Evert	21
1977	Virginia Wade	32
1978	Martina Navrátilová	21
1979	Martina Navrátilová	22
1980	Evonne Goolagong-Cawley	28
1981	Chris Evert-Lloyd	26
1982	Martina Navrátilová	25
1983	Martina Navrátilová	26
1984	Martina Navrátilová	27
1985	Martina Navrátilová	28
1986	Martina Navrátilová	29
1987	Martina Navrátilová	30
1988	Steffi Graf	19
1989	Steffi Graf	20
1990	Martina Navrátilová	33
1991	Steffi Graf	22
1992	Steffi Graf	23
1993	Steffi Graf	24
1994	Conchita Martínez	22
1995	Steffi Graf	26
1996	Steffi Graf	27
1997	Martina Hingis	16
1998	Jana Novotná	29
1999	Lindsay Davenport	23
2000	Venus Williams	20
2001	Venus Williams	21
2002	Serena Williams	20
2003	Serena Williams	21
2004	Maria Sharapova	17
2005	Venus Williams	25
2006	Amélie Mauresmo	27
2007	Venus Williams	27

3.6.1: Tennis Anyone? (continued)

Womens Doubles Champions, Wimbledon, 1968 to present

Year	Womens Doubles Champions	Ages
1968	Rosie Casals/Billie Jean King	19/24
1969	Margaret Smith Court/Judy Tegart Dalton	26/31
1970	Rosie Casals/Billie Jean King	21/26
1971	Rosie Casals/Billie Jean King	22/27
1972	Billie Jean King/Betty Stove	28/27
1973	Rosie Casals/Billie Jean King	24/29
1974	Evonne Goolagong/Peggy Michel	22/25
1975	Ann Kiyomura/Kazuko Sawamatsu	19/24
1976	Chris Evert/Martina Navrátilová	21/19
1977	Helen Gourlay Cawley/JoAnne Russell	30/22
1978	Kerry Reid/Wendy Turnbull	30/25
1979	Billie Jean King/Martina Navrátilová	35/22
1980	Kathy Jordan/Anne Smith	20/21
1981	Martina Navrátilová/Pam Shriver	24/19
1982	Martina Navrátilová/Pam Shriver	25/20
1983	Martina Navrátilová/Pam Shriver	26/21
1984	Martina Navrátilová/Pam Shriver	27/22
1985	Kathy Jordan/Elizabeth Smylie	25/22
1986	Martina Navrátilová/Pam Shriver	29/24
1987	Claudia Kohde-Kilsch/Helena Suková	23/22
1988	Steffi Graf/Gabriela Sabatini	19/18
1989	Jana Novotná/Helena Suková	20/24
1990	Jana Novotná/Helena Suková	21/25
1991	Larisa Neiland/Natasha Zvereva	24/20
1992	Gigi Fernandez/Natasha Zvereva	28/21
1993	Gigi Fernandez/Natasha Zvereva	29/22
1994	Gigi Fernandez/Natasha Zvereva	30/23
1995	Jana Novotná/Arantxa Sánchez Vicario	26/23
1996	Martina Hingis/Helena Suková	15/31
1997	Gigi Fernandez/Natasha Zvereva	33/26
1998	Martina Hingis/Jana Novotná	17/29
1999	Lindsay Davenport/Corina Morariu	23/21
2000	Serena Williams/Venus Williams	18/20
2001	Lisa Raymond/Rennae Stubbs	27/30
2002	Serena Williams/Venus Williams	20/22
2003	Kim Clijsters/Ai Sugiyama	20/27
2004	Cara Black/Rennae Stubbs	25/33
2005	Cara Black/Liezel Huber	26/28
2006	Zi Yan/Jie Zheng	21/23
2007	Cara Black/Liezel Huber	28/30

3.6.1: Tennis Anyone? (continued)

Mens Singles Champions, Wimbledon, 1968 to present

Year	Mens Champion	Age
1968	Rod Laver	29
1969	Rod Laver	30
1970	John Newcombe	25
1971	John Newcombe	26
1972	Stan Smith	25
1973	Jan Kodeš	27
1974	Jimmy Connors	21
1975	Arthur Ashe	32
1976	Björn Borg	20
1977	Björn Borg	21
1978	Björn Borg	22
1979	Björn Borg	23
1980	Björn Borg	24
1981	John McEnroe	22
1982	Jimmy Connors	29
1983	John McEnroe	24
1984	John McEnroe	25
1985	Boris Becker	17
1986	Boris Becker	18
1987	Pat Cash	22
1988	Stefan Edberg	22
1989	Boris Becker	21
1990	Stefan Edberg	24
1991	Michael Stich	22
1992	Andre Agassi	22
1993	Pete Sampras	21
1994	Pete Sampras	22
1995	Pete Sampras	23
1996	Richard Krajicek	24
1997	Pete Sampras	25
1998	Pete Sampras	26
1999	Pete Sampras	27
2000	Pete Sampras	28
2001	Goran Ivanišević	29
2002	Lleyton Hewitt	21
2003	Roger Federer	21
2004	Roger Federer	22
2005	Roger Federer	23
2006	Roger Federer	24
2007	Roger Federer	25

3.6.1: Tennis Anyone? (continued)

Mens Doubles Champions, Wimbledon, 1968 to present

Year	Mens Doubles Champions	Ages
1968	John Newcombe/Tony Roche	24/23
1969	John Newcombe/Tony Roche	25/24
1970	John Newcombe/Tony Roche	26/25
1971	Roy Emerson/Rod Laver	33/32
1972	Bob Hewitt/Frew McMillan	32/30
1973	Jimmy Connors/Ilie Năstase	20/26
1974	John Newcombe/Tony Roche	30/29
1975	Vitas Gerulaitis/Sandy Mayer	20/23
1976	Brian Gottfried/Raul Ramirez	24/23
1977	Geoff Masters/Ross Case	27/25
1978	Bob Hewitt/Frew McMillan	38/36
1979	Peter Fleming/John McEnroe	24/20
1980	Peter McNamara/Paul McNamee	25/25
1981	Peter Fleming/John McEnroe	26/22
1982	Peter McNamara/Paul McNamee	27/27
1983	Peter Fleming/John McEnroe	28/24
1984	Peter Fleming/John McEnroe	29/25
1985	Heinz Günthardt/Balazs Taroczy	26/31
1986	Joakim Nyström/Mats Wilander	23/21
1987	Ken Flach/Robert Seguso	24/24
1988	Ken Flach/Robert Seguso	25/25
1989	John Fitzgerald/Anders Järryd	28/27
1990	Rick Leach/Jim Pugh	25/26
1991	John Fitzgerald/Anders Järryd	30/29
1992	John McEnroe/Michael Stich	33/23
1993	Todd Woodbridge/Mark Woodforde	22/27
1994	Todd Woodbridge/Mark Woodforde	23/28
1995	Todd Woodbridge/Mark Woodforde	24/29
1996	Todd Woodbridge/Mark Woodforde	25/30
1997	Todd Woodbridge/Mark Woodforde	26/31
1998	Jacco Eltingh/Paul Haarhuis	27/32
1999	Mahesh Bhupathi/Leander Paes	25/26
2000	Todd Woodbridge/Mark Woodforde	29/34
2001	Don Johnson/Jared Palmer	32/30
2002	Todd Woodbridge/Jonas Björkman	31/30
2003	Todd Woodbridge/Jonas Björkman	32/31
2004	Todd Woodbridge/Jonas Björkman	33/32
2005	Stephen Huss/Wesley Moodie	29/26
2006	Bob Bryan/Mike Bryan	28/28
2007	Arnaud Clement/Michael Llodra	29/27

Unit 3: Day 7: Tennis Anyone? (Part 2)

Minds On: 5 Action: 55 Consolidate:15 Total=75 min	**Learning Goal**: • Generate a graphical summary (box and whisker plot, histogram) of a one-variable data set. • Calculate measures of central tendency for a one-variable data set. • Draw conclusions from the results of one-variable statistical analysis.	**Materials** • BLM 3.7.1 • Technology (Fathom 2, Excel, TI-83)

			Assessment Opportunities
	Minds On…	**Small Groups → Discussion** In their groups, students share responses to the statement, "In my group, my role is to…" (from Unit 3, Day 6, Part 1)	
	Action!	**Small Groups → Tennis Anyone?** Students get into their groups from the previous day and share the results of their analysis. Using BLM 3.7.1, students record their conclusions. **Curriculum Expectations/Obersvation/Checkbric** Observe students as they discuss the results of their statistical analysis. Check that the students have an accurate understanding of measures of central tendency.	➲
	Consolidate Debrief	**Whole Class → Discussion** Lead student discussion regarding their analysis and the conclusions. **Process Expectations/Observation/Mental Note** Observe students' reasoning skills as they discuss what conclusions can be drawn from their analysis.	➲
Reflection		**Home Activity or Further Classroom Consolidation** Complete a journal entry responding to the question: How might your research into prime athletic age be taken further?	

3.7.1: Tennis Anyone?

Question: Do men and women reach their "athletic prime" at different ages?

Results: as your partners present their findings, take note of the important details (e.g., mean, median, standard deviation). In the blank provided, record your partner's name.

Womens Singles: _____

_____

_____

_____

Mens Singles: _____

_____

_____

_____

Womens Doubles: _____

_____

_____

_____

Mens Doubles: _____

_____

_____

_____

3.7.1: Tennis Anyone? (continued)

Compare the median age of the singles champions with the median age of the doubles champions. What factors could account for any differences?

_____

_____

_____

_____

Why might you expect the upper extreme age of the doubles champions to be higher than the upper extreme age of the singles champions?

_____

_____

_____

_____

After reviewing the work of your group, what is your conclusion regarding athletic prime?

_____

_____

_____

_____

What limitations must you place on your conclusions?

_____

_____

_____

_____

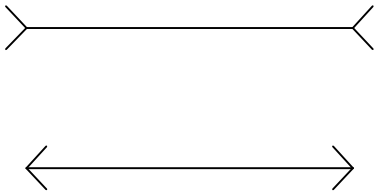
Unit 3: Day 8: A Question Of Fit

Minds On: 5 Action: 55 Consolidate:15 Total=75 min	**Learning Goal**: • Determine, through investigation, a linear model for a bivariate set of data using technology. • Decide if a linear model is appropriate for a bivariate set of data by discussing the correlation coefficent and the coefficient of determination.	**Materials** • BLM 3.8.1 to 3.8.3 • Acetate sheets • Technology (Fathom 2)

				Assessment Opportunities
	Minds On…	**Whole Group → Discussion** Students in a discussion regarding the intuitive aspect of approximation. Using BLM 3.8.1 on acetate, demonstrate how intuition can sometimes be faulty.		Note that the last two examples of BLM 3.8.1 are timed!
	Action!	**Think, Pair, Share → Does it Fit?** Independently and then in pairs, students discuss the accuracy of the lines of best fit given on BLM 3.8.2. **Process Expectations/ Observation/Mental Note:** Observe students as they discuss the accuracy of the line of best fit. Check for opportunities to discuss residuals and sum of squares. **Whole Class → Go for the Gold!** Using BLM 3.8.3, students investigate Olympic gold medal long jump distances over time.		Fathom 2 is necessary for the instructions given in BLM 3.8.1
	Consolidate Debrief	**Whole Class → Discussion** Lead student discussion regarding their analysis and the conclusions. Describe the roles of the correlation coefficient and the coefficient of determination. **Curriculum Expectations/Observation/Anecdotal Notes:** Observe students as they discuss what conclusions can be drawn from their analysis.		
	Reflection	**Home Activity or Further Classroom Consolidation** In your journal, discuss how your intuition differed from the mathematics when you found the line of best fit.		

3.8.1: Intuition

1. Which line is longest?



2. Three friends go out for coffee and dessert. They each put down a $10 bill for their meal (for which they were billed $25). Knowing that they cannot split the $5 in change three ways, one of the friends offers the waiter a $2 tip. The remaining $3 is then distributed equally between the friends. If the friends each paid $9 (which makes their total cost $27) and the waiter received a $2 tip, what happened to the missing dollar (since $27 + $2 = $29)?

3. Read the sentence below and count the number of words. Read it only once.

PARIS IN THE
THE SPRING.

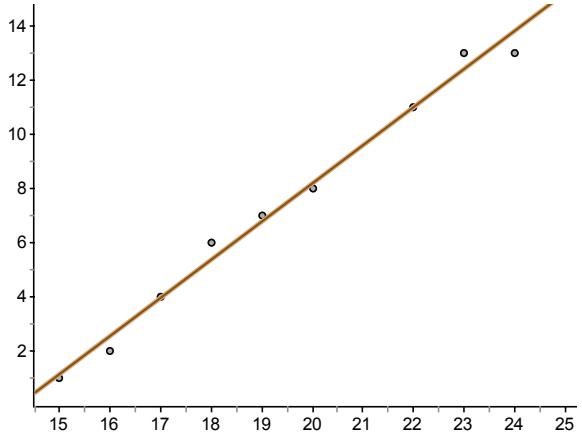
4. Read the sentence below and count the number of F's. Read the sentence only once.

FINISHED FILES ARE THE RESULT OF
YEARS OF SCIENTIFIC STUDY COMBINED
WITH THE EXPERIENCE OF YEARS

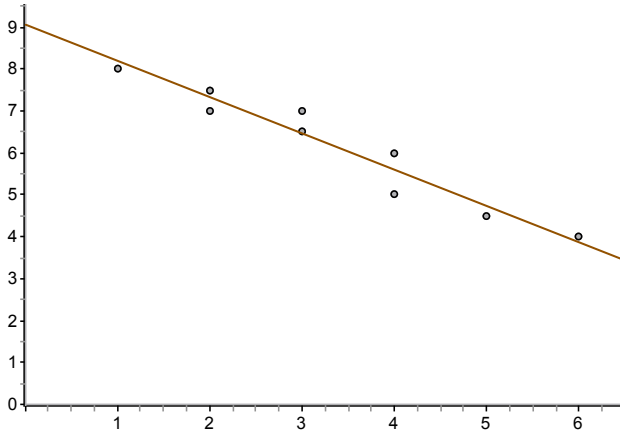
3.8.2: Does It Fit?

For each of the scatter plots below, discuss with a partner the accuracy of the provided line of best fit.

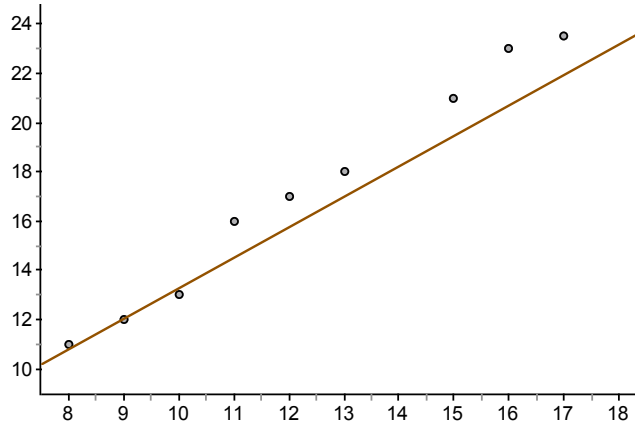
a)



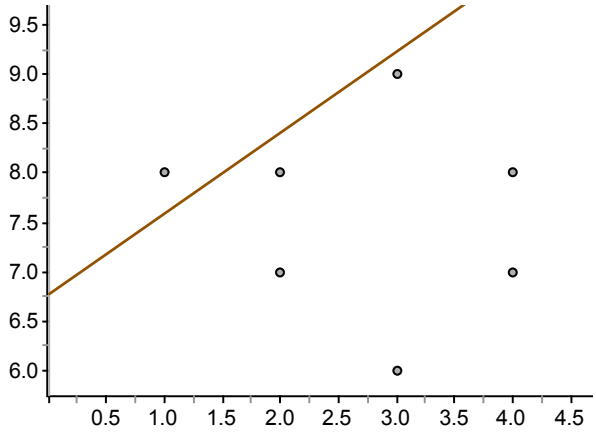
b)



c)



d)



What criteria did you use you make your judgements regarding accuracy?

_____

_____

_____

_____

3.8.3: Go for the Gold!

The data provided in the table below are the gold medal winning distances for the mens and womens divisions at the Olympics from 1948 to present. Using Fathom 2, enter the data into a table.

Year	Mens Distance (m)	Womens Distance (m)
1948	7.82	5.69
1952	7.57	6.24
1956	7.83	6.35
1960	8.12	6.37
1964	8.07	6.76
1968	8.90	6.82
1972	8.24	6.87
1976	8.34	6.72
1980	8.54	7.06
1984	8.54	6.96
1988	8.72	7.40
1992	8.67	7.14
1996	8.50	7.12
2000	8.55	6.99
2004	8.59	7.07

Make two scatter plot graphs – Mens Distance vs. Year and Womens Distance vs. Year. For each graph, add a movable line (this feature is hidden in the Graph menu). Using your mouse, move this line until you have approximated the line of best fit.

Under the Graph menu, select “Show Squares”. This displays the “Sum of Squares” in the bottom left of your graph – the line of best fit is obtained when this number is minimized. Alter your movable line so that this value is as small as possible.

When you’re satisfied that your line is as accurate as possible, select “Least-Squares Line” from the Graph menu. This feature places the mathematically generated line of best fit. How close was your approximation?

Create a summary. Place the Year attribute in the column header. Drag the Mens Distance and Womens Distance attirubutes into the row cells. By default, Fathom 2 will now calculate the correlation coefficient (r). How does this value compare to the coefficient of determination (r^2) as given in the scatter plots?

Unit 3: Day 10: Understanding Correlation – Part 1

Minds On: 5 Action: 50 Consolidate:20 Total=75 min	**Learning Goal**: • Explore different types of relationships between two variables.	**Materials** • BLM 3.10.1 • Acetate sheets • Overhead projector

				Assessment Opportunities
	Minds On…	**Whole Class → Discussion** Discuss the observation that "Drivers of red cars are twice as likely to be involved in an accident as drivers of blue cars." Does this imply that driving a red car "causes" drivers to have an accident? This is an example of misinterpreting a "common-cause relationship" as aggressive drivers tend to prefer red cars.		
	Action!	**Whole Class → Discussion** Define causation and correlation. Students engage in a discussion regarding how causation is just one of three possible relationships between two correlated variables: a) Causation or cause-and-effect relationship - a change in X is necessary and sufficient for a change in Y. b) Common-cause Relationship - both X and Y change in common to some third, unseen variable (Sometimes referred to as a "lurking" variable). c) Accidental Relationship - the effects of X and Y are unrelated to each other and their correlation is accidental. **Small Groups → Discussion** With reference to BLM 3.10.1, students discuss their response to the seven questions. **Process Expectations/Questioning/Anecdotal Feedback** Dialogue with groups as they develop their understanding of correlation and causation. **Whole Class → Discussion** Lead students in a review of the scenarios addressed in BLM 3.10.1. **Individual → Activity** Using the Internet, or copies of newspapers/magazines, students find examples in the media where correlation is used to imply causation. Consideration may also be given to instances where data has been "distorted" in its representation.		Definition: **Causation** is the relationship between **causes** and **effects.** Event A **causes** event B to occur if A occurring is a necessary and sufficient reason for event B to occur. Definition: **Correlation** is a measure of the strength of the relationship between two variables. Types of Correlation: Positive Negative Strong Moderate Weak No correlation.
	Consolidate Debrief	**Whole Class → Discussion** Students to present some of the examples that they found where correlation is used to imply causation.		
Exploration Application		**Home Activity or Further Classroom Consolidation** Conduct on-line research to determine how statistical results should be used appropriately for reporting purposes.		

3.10.1: Correlation is NOT Causation!

In your groups, read over each of these reported findings. As a group, first establish whether there is correlation between the two events and then decide whether the relationship is cause-effect, common-cause or accidental.

1. A higher number of ice cream sales corresponds to a higher number of shark attcks on swimmers.

   Does this mean that increased ice cream sales CAUSES the number of shark attacks on swimmers to increase?

2. The number of cavities in elementary school children and vocabulary size have a strong positive correlation.

   Does this mean that increasing the number of cavities in elementary school children CAUSES their vocabulary size to increase?

3. In a growing municipality, the traffic planner (who never completed Data Management class) observed that over a period of ten years the number of traffic accidents showed a high positive correlation with the number of traffic lights installed.

   Was the planner correct in suggesting to the Mayor that they remove all the traffic lights to reduce the accident rate?

4. There is a strong, positive correlation between the number of fire engines responding to a fire and the damage caused by the fire. Does this suggest that reducing the number of responding fire engines will result in less fire damage? Why or why not?

5. Every time that I eat chocolate, I get acne. Does this mean that, for me, eating chocolate causes acne? Why or why not? Hint: Consider situations when I might want to eat chocolate and when I get acne (i.e. increased stress/anxiety).

6. It has been observed that the number of rings in a tree stump correspond roughly with the age of the tree.

7. Humans have 23 chromosome pairs. The earth's axis is tilted at approximately 23 degrees.

Unit 3: Day 11: Understanding Correlation – Part 2

Minds On: 5
Action: 50
Consolidate: 20
Total=75 min

Learning Goal:

- Interpret statistical summaries to describe and compare the characteristics of two variable statistics.

Materials

- BLM 3.11.1
- BLM 3.11.2
- Overheads
- Overhead projector

Assessment Opportunities

Minds On…

Whole Class → Discussion

On your first Unit Test in Data Management your marks are distributed according to the table below:

Mark	Number of Students
45%	4
58%	1
63%	1
95%	1
98%	3
100%	3

Class Size	13
Mean	76%
Median	98%
Mode	45%

The mean, median, and mode can each, in some sense, be considered the "average" of the test. If you were the teacher why might you think the test was too easy? What "average mark" would the teacher use to justify the test to the principal? If you were the student who received 58%, what would you tell your parents that the average on the test was? Who is "right"? Interpretation of statistics is equally as important as the calculation of statistics.

Supplemental:

Discuss with students the problem associated with a test or other evaluation that has a bi-modal distribution of marks.

Action!

Individual Activity → A Marked Improvement

Students complete BLM 3.11.1 as an In Class Assignment.

Process Expectations/Performance Task/Rubric:

Assess the students on the A Marked Improvement activity using BLM 3.11.2

Consolidate Debrief

Whole Class → Discussion

Using BLM 3.11.1 (Teacher Notes) discuss with the class appropriate responses to A Marked Improvement.

Exploration Application

Home Activity or Further Classroom Consolidation

Under what circumstances would we "reasonably" expect correlation to "suggest" or "strongly imply" causation to the degree that would allow us to make responsible choices throughout our daily life? You may wish to conduct some research into the various philosophies concerning causation.

3.11.1: A Marked Improvement

In order to convince students as to the value of attending classes, a teacher has compiled statistics on the attendance and final marks of ten students chosen randomly from her past Data Management classes. Help this teacher out by completing her analysis of this data.

Student	Classes Missed (x)	Final Mark (y)	x * y	x^2	y^2
1	0	95	0	0	9025
2	9	65	585	81	4225
3	2	85	170	4	7225
4	8	80	640	64	6400
5	3	87	261	9	7569
6	12	60	720	144	3600
7	0	74	0	0	5476
8	1	88	88	1	7744
9	6	75	450	36	5625
10	14	55	770	196	3025
N=10	$\sum x =$	$\sum y =$	$\sum xy =$	$\sum x^2 =$	$\sum y^2 =$

By adding up the appropriate columns, complete the last row of the table above.

1. Using technology, complete a scatter plot using "Classes Missed" as the horizontal scale and "Final Mark" as the vertical scale.

2. By looking at the scatter plot, make a "guess" as to whether the correlation will be:

   a) Positive or Negative
   b) Stong, Moderate, Weak, No Correlation

3. Using appropriate interval sizes, complete the frequency table below for the above distribution.

Frequency Table (Fill in the blanks)

Classes Missed (x) Interval	Freq	Final Mark (y) Interval	Freq
0 - 2.5	4	54.5 - 60.5	
2.5 - 4.5			
	2		2
10.5 - 12.5	0	84.5 - 90.5	3
12.5 - 14.5	1		1

3.11.1: A Marked Improvement (Continued)

4. Using appropriate technology, draw frequency distribution histograms for Classes Missed and Final Marks distributions.

5. Using appropriate technology, calculate the required values and complete the table below:

   Descriptive Statistics (Calculate values correct to two decimal places)

Variable	Mean	StDev	Variance	Sum	Minimum	Maximum	Range
Classes Missed				55			
Final Mark				764			

6. Below is the formula for the correlation coefficient, r.

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

Where:

- N = number of pairs of scores
- Σxy = sum of the products of paired scores
- Σx = sum of x scores
- Σy = sum of y scores
- Σx^2 = sum of squared x scores
- Σy^2 = sum of squared y scores

Using the above table of values, state the values for: $N, \sum x, \sum y, \sum xy, \sum x^2, \sum y^2$

7. Calculate r (correct to five decimal places) using the given formula and the values obtained above. Also calculate r using technology. Compare the two answers.

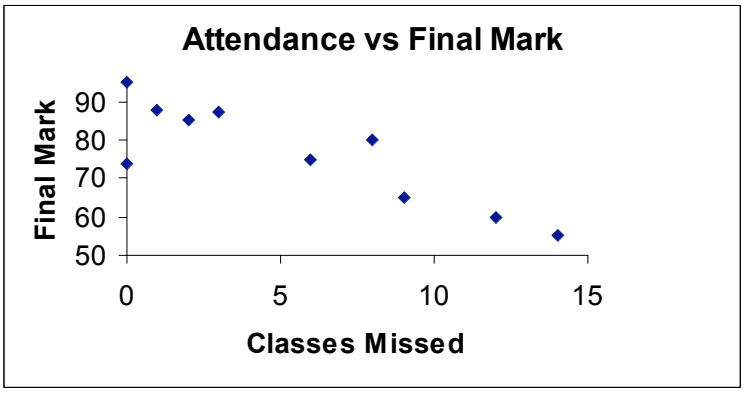
8. Does this value of r agree with your "guess" in Question 2 as to the correlation between "Classes Missed" and "Final Mark"?

9. Based on your calculated value for r, would you agree with the teacher's suggestion that missing Data Management classes "causes" students to have a lower final mark? Why or why not? You may wish to consider lurking variables (hidden variables) and/or common cause variables (factors affecting both variables).

3.11.1: A Marked Improvement (Teacher Notes)

Student	Classes Missed (x)	Final Mark (y)	x * y	x^2	Y^2
1	0	95	0	0	9025
2	9	65	585	81	4225
3	2	85	170	4	7225
4	8	80	640	64	6400
5	3	87	261	9	7569
6	12	60	720	144	3600
7	0	74	0	0	5476
8	1	88	88	1	7744
9	6	75	450	36	5625
10	14	55	770	196	3025
Sum	55	764	3684	535	59914

1. **Scatter Plot**:



2. There appears to be a strong negative correlation between Final Mark and Classes Missed.

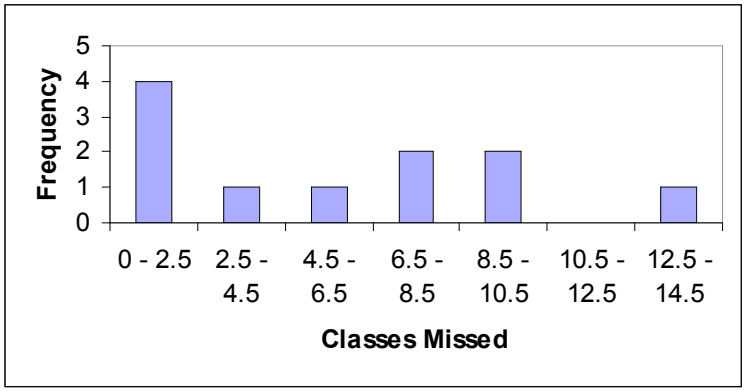
3. Frequency Table

Classes Missed (x) Interval	Freq	Final Mark (y) Interval	Freq
0 - 2.5	4	54.5 - 60.5	2
2.5 - 4.5	1	60.5 - 66.5	1
4.5 - 6.5	1	66.5 - 72.5	0
6.5 - 8.5	2	72.5 - 78.5	2
8.5 - 10.5	2	78.5 - 84.5	1
10.5 - 12.5	0	84.5 - 90.5	3
12.5 - 14.5	1	90.5 - 96.5	1

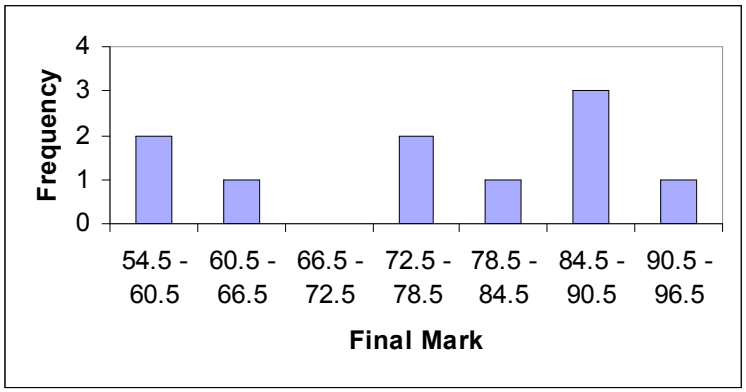
3.11.1: A Marked Improvement (Teacher Notes) (Continued)

4. Frequency Distributions

Classes Missed Frequency Distribution



Final Mark Frequency Distribution



5. Descriptive Statistics

Variable	Mean	StDev	Variance	Sum	Minimum	Maximum	Range
Classes Missed	5.50	5.08	25.83	55	0	14	14
Final Mark	76.40	13.10	171.60	764	55	95	40

3.11.1: A Marked Improvement (Teacher Notes) (Continued)

6. We have:

$N = 10$

$\sum xy = 3684$

$\sum x = 55$

$\sum y = 764$

$\sum x^2 = 535$

$\sum y^2 = 59914$

$$r = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)^2][N\Sigma y^2 - (\Sigma y)^2]}}$$

Where:

N	=	number of pairs of scores
Σxy	=	sum of the products of paired scores
Σx	=	sum of x scores
Σy	=	sum of y scores
Σx^2	=	sum of squared x scores
Σy^2	=	sum of squared y scores

7. Calculation of correlation coefficient:

$$\therefore r = \frac{(10)(3684) - (55)(764)}{\sqrt{\left(10(535) - 55^2\right)\left(10(59914) - 764^2\right)}}$$

$$\approx \frac{-5180}{5992.270021}$$

$$\approx -0.8644$$

Thus, indeed, there is a strong negative correlation between final mark and classes missed.

Using Excel or Fathom we also determine r as approximately –0.86444

8. This value of r agrees with the guess in Question 2.

9. Correlation does not "prove" causation. Consideration must be given to other factors that could potentially influence one or both variables.

- Students may have taken the course before.
- Students who are academically successful may be more inclined to attend class regularly.
- Students who attend class regularly may have a positive disposition towards the course and hence are more academically successful.
- Students who are frequently absent may have other factors in their life that negatively influence their academic success (i.e. part-time jobs, stressful family situation, excessive extracurricular commitments, health, etc.).

3.11.2: A Marked Improvement Rubric

Reasoning and Proving				
Criteria	Level 1	Level 2	Level 3	Level 4
Making inferences, conclusions and justifications	Justification of the answer presented has a limited connection to the problem solving process and models presented	Justification of the answer presented has some connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented, with evidence of reflection

Connecting				
Criteria	Level 1	Level 2	Level 3	Level 4
Making connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

Communicating				
Criteria	Level 1	Level 2	Level 3	Level 4
Degree of clarity in explanations and justifications in reporting	Explanations and justifications are partially understandable	Explanations and justifications are understandable by me, but would likely be unclear to others	Explanations and justifications are clear for a range of audiences	Explanations and justifications are particularly clear and detailed

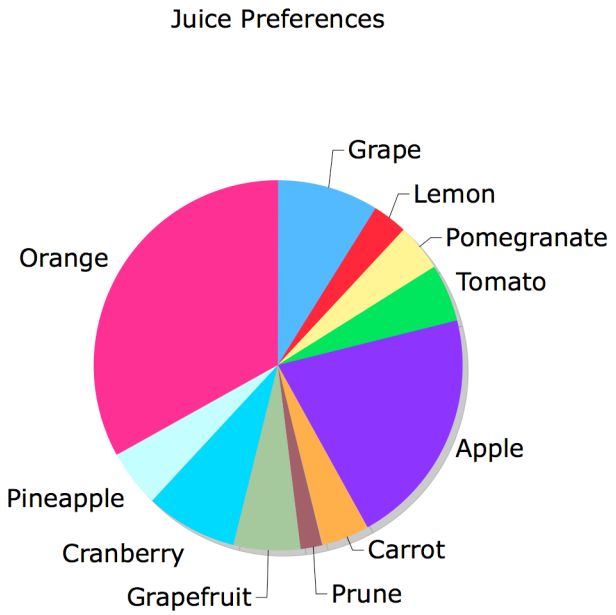
Unit 3: Day 13: Just Desserts

Minds On: 5 Action: 50 Consolidate:20 Total=75 min	**Learning Goal**: • Investigate how statistical summaries can be used to misrepresent data. • Make inferences and justify conclusions from statistical summaries.	**Materials** • BLM 3.13.1 to 3.13.2

			Assessment Opportunities
	Minds On…	**Whole Class → Discussion** Write a 10-digit number on the board, perhaps 4671225531. Challenge the students to convert this number into something meaningful by adding two brackets and a dash. Answer: (467) 122-5531. Use this example as a springboard to engage students in a discussion of the difference between "data" and "information".	
	Action!	**Small Groups → Pie Anyone?** Using BLM 3.13.1, students investigate two different representations of data (pie graphs and bar charts) by attempting to estimate the relative values of the source data. Distribute the first two pages, but hold the last one until the entire class is ready – the last page contains the source data. **Process Expectations/Questioning/Checkbric** Observe students and have them answer questions as they investigate different representations of data.	
	Consolidate Debrief	**Whole Class → Discussion** Students are lead through a discussion regarding the graphs provided in BLM 3.13.2. Highlight the importance of scale and how it can skew the perception of the data. **Curriculum Expectations/Observation/Mental Note** Observe students as they discuss their thoughts.	
	Application	**Home Activity or Further Classroom Consolidation** Devise a data set in which a three-dimensional graph would be better than a two-dimensional graph.	

3.13.1: Pie Anyone?

The results of a recent survey on favourite flavour of juice are represented in the pie chart below. If the total of the references sums to 100%, what percentage would you assign to each of the flavours?



Grape:

Lemon:

Pomegranate:

Tomato:

Apple:

Carrot:

Prune:

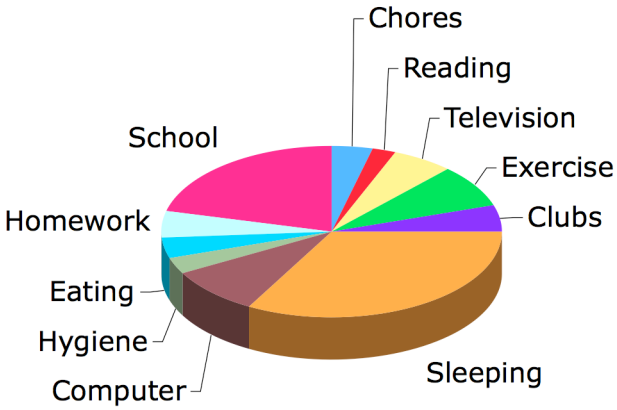
Grapefruit:

Cranberry:

Pineapple:

Orange:

A budget of weekly time (as a percent) is shown below. Estimate the percentage pf time spent on each task.?



Chores:

Reading:

Television:

Exercise:

Clubs:

Sleeping:

Computer:

Hygiene:

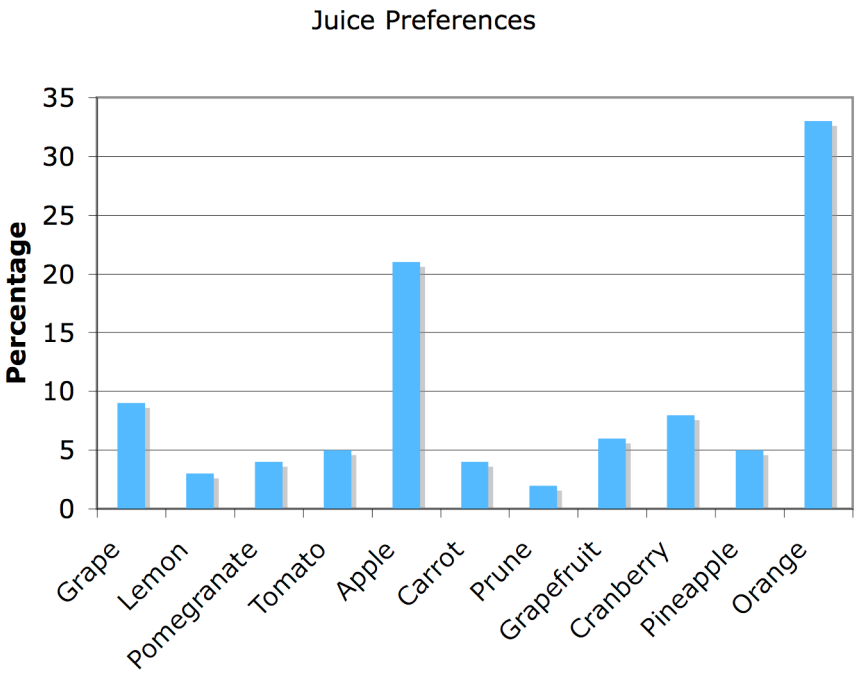
Eating:

Homework:

School:

3.13.1: Pie Anyone? (continued)

Use the bar chart below to estimate juice flavour preferences. Did any of your estimates from the pie chart did you have to change? Why?



Grape:

Lemon:

Pomegranate:

Tomato:

Apple:

Carrot:

Prune:

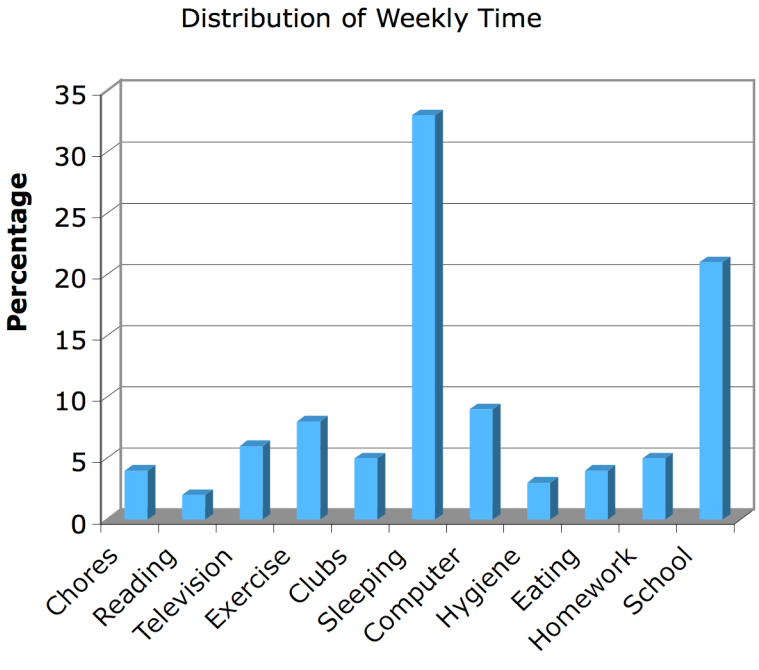
Grapefruit:

Cranberry:

Pineapple:

Orange:

Use the bar chart below to estimate the percentage of time spent on each task. Did any of your estimates from the pie chart did you have to change? Why?



Chores:

Reading:

Television:

Exercise:

Clubs:

Sleeping:

Computer:

Hygiene:

Eating:

Homework:

School:

3.13.1: Pie Anyone? (continued)

The source data for the charts are shown in the tables below. Compare the results for chores and carrot; reading and prune; television and grapefruit; exercise and cranberry. Note: all four graphs used the same set of numbers.

	Distribution of Weekly Time
Chores	4
Reading	2
Television	6
Exercise	8
Clubs	5
Sleeping	33
Computer	9
Hygiene	3
Eating	4
Homework	5
School	21

	Juice Preferences
Grape	9
Lemon	3
Pomegranate	4
Tomato	5
Apple	21
Carrot	4
Prune	2
Grapefruit	6
Cranberry	8
Pineapple	5
Orange	33

1. Which of the four charts do you find to be most accurate for estimating data? Why?

_____

_____

_____

_____

2. Sleeping and orange juice were both at 33%. In which of the four representations did you estimate it highest? What features of this representation might make this happen?

_____

_____

_____

3. Which is better for data representation – 2D or 3D? Why?

_____

_____

_____

3.13.2: Making The Grade

Compare the two charts below. Is there an ethical issue at play?