Eastern West Virginia Community and Technical College
COURSE ASSESSMENT REPORT

Course Title and Number: MTH 102 – Math for Elementary Teachers	Academic Term and Year of Assessment Activity (Ex: Fall, 2014) Fall 2017
Report Submitted By: Andrea Williams	Number of Students Assessed: 3
Date Report Submitted: 1/4/18	Number of Sections Included: 1
Course Delivery Format (list all modalities used in sections assessed. Ex: web based, VDL, traditional section, hybrid course, etc.): Traditional section	

Course Role in the Curriculum
Provide a description of the role the course serves in the curriculum (i.e. general education requirement, program technical core, restricted elective, etc.). Note all as appropriate.
MTH 102 is a technical core course for the Shepherd University 2 + 2 Agreement for Elementary Education. This course does not satisfy the general education requirements for college-level math.

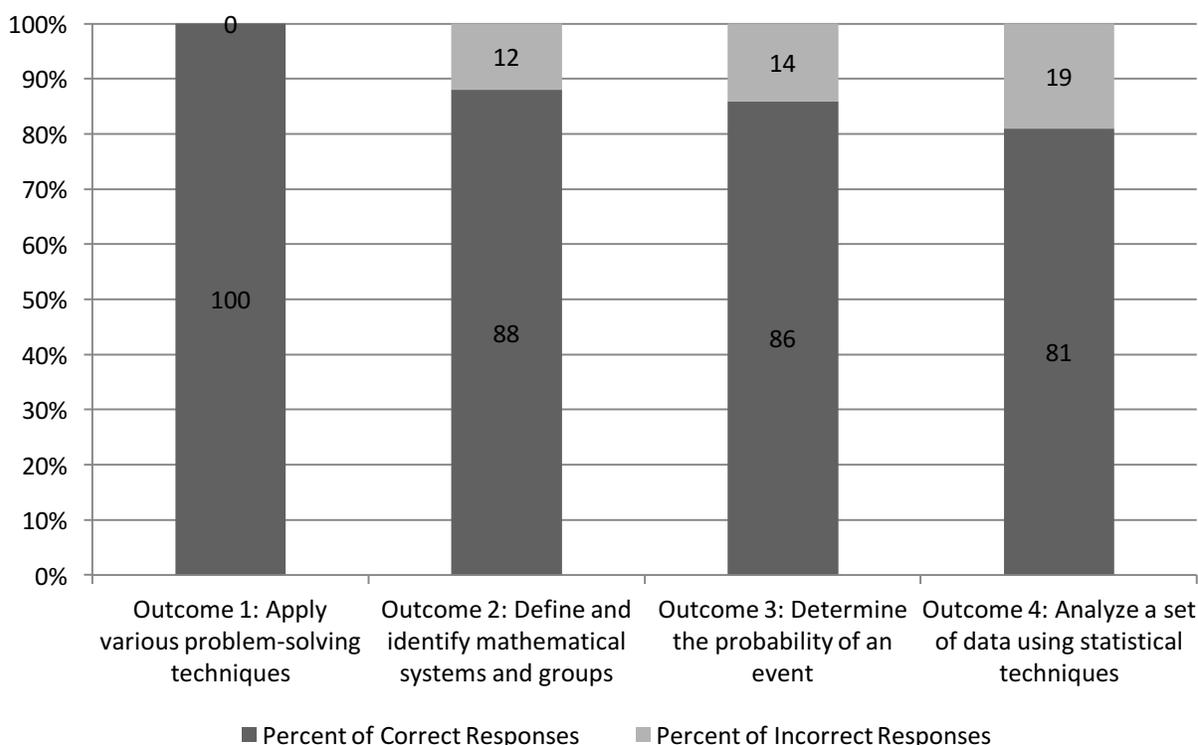| Assessment Methods |
|---|
| **Provide a description of the assessment process used. Include description of instrument and performance standards in description. Note all methods.** |
| The final exam review assignment and final exam are used as a basis for this assessment. The final exam review was given through MyMathLab, the online homework platform utilized throughout the course. Students were given questions similar to what they would see on the final exam. They had unlimited attempts at each question but did not have access to all of the learning aids they had for other homework assignments throughout the semester. Students had approximately two weeks to complete the assignment prior to the final exam. The review was weighted as a test grade. Although some questions had multiple parts, for purposes of this analysis, only questions receiving full credit are considered correct.

The final was a paper exam given in two parts on two days. Students were allowed to use a scientific calculator and a 3x5 index card of notes they created. The students were also provided with the systems of numeration symbols, geometry formulas, and a z-score table on the appropriate day. Students were given partial credit based on the work they showed on their test paper, but for purposes of this analysis, only questions receiving full credit are considered correct.

Multiple questions are included in each outcome for analysis. A minimum satisfactory percent of correct responses for each outcome is 75%. |

Assessment Results
Provide a summary of results including tables/charts. Incorporate information from previous assessments as appropriate. Append additional pages if necessary. If appending, include notation in box to "See attached".
Four outcomes were analyzed, the one that failed to meet the minimum performance standard on the

last assessment and three new outcomes that were not assessed previously. All four met the 75% correct criterion, a slight improvement over the previous assessment. Mostly importantly, the outcome not met on the last assessment exceeded the standard at 88% with this cohort.

MTH 102 Fall 2017
Analysis of Selected Outcomes

Outcome	Percent of Correct Responses	Percent of Incorrect Responses
Outcome 1: Apply various problem-solving techniques	100	0
Outcome 2: Define and identify mathematical systems and groups	88	12
Outcome 3: Determine the probability of an event	86	14
Outcome 4: Analyze a set of data using statistical techniques	81	19

■ Percent of Correct Responses   ■ Percent of Incorrect Responses

Course Level Assessment Summary of Outcomes, Indicators and Results Add additional rows to table if necessary				
Learning Outcomes (Insert learning outcomes assessed during this cycle)	Indicator + (Insert indicators used for each outcome: exam question, scoring rubric, etc. Be specific)	Percent of Correct Responses^	Percent of Incorrect Responses	Performance Standard Met (75%)* (yes or no)
Outcome 1: Apply various problem-solving techniques	Final Exam Review 1.1 Final Exam 1.3, 1.4	100%	0%	Yes
Outcome 2: Define and identify mathematical systems and groups	Final Exam Review 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11 Final Exam 2.1, 2.2, 2.3, 2.4, 2.5	88%	12%	Yes

Outcome 3: Determine the probability of an event	Final Exam Review 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24, 2.25 Final Exam 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14	86%	14%	Yes
Outcome 4: Analyze a set of data using statistical techniques	Final Exam Review 2.26, 2.27, 2.28, 2.29, 2.30, 2.31, 2.32, 2.33, 2.34, 2.35 Final Exam 2.15, 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24, 2.25	81%	19%	Yes

* Please note if using a different minimum performance standard.
+ See Attachment 1 for questions.
^ The final exam review was worth 5% of the final course grade; the final exam was worth 20%. The percent of correct responses was calculated as a weighted average based on these percentages.

Conclusions
Provide a brief summary of conclusions derived based on analysis of data. Append additional pages if necessary. If appending, include notation in box to "See attached".

This assessment included a very small sample size so results may not be indicative of future sections, but since this course is exclusively for Shepherd Elementary Education majors, the typical MTH 102 student seems to be very focused and motivated. The revisions made since the last assessment (see below) appear to have been effective, so they will continue to be implemented with the goal of at least maintaining the current performance level.

This was also the first time the final exam review assignment has been included in the course assessment in addition to the final exam. Incorporating more performance indicators provides a better picture of what the students gained from the course.

Previous Assessment Reports and Results
Date of Previous Assessment: Fall 2015
List of Outcomes Not Met: Define and identify mathematical systems and groups
Summary of Actions Taken to Address Unmet Learning Outcomes: Append additional pages if necessary. If appending, include notation in box to "See attached".

From the previous assessment report:
This outcome was undoubtedly the most abstract topic of the course and the one with which the students likely had no exposure prior to taking this course. Specifically, the students struggled with the sub-outcomes which involved identifying groups and their properties. They did much better with the topics involving modular arithmetic, a much more applicable concept. Further consideration will be given to how much exposure to group theory these students really need. Perhaps time would be better spent giving just a synopsis of the topic and then focusing on modular arithmetic for the bulk of the unit. If it is decided that groups need to continue to be covered thoroughly, more in-class examples and more homework problems will be added.

After reviewing the outcomes for the course, it was decided to retain all of the sub-outcomes related to

groups; however, emphasis was shifted from the theoretical concepts to the applied. Ample time and examples were devoted to the abstract topics the students were still expected to know.

Action Plan and Date for Reassessment
Identify action plan for improvement or maintaining current performance levels including outcomes identified for re-assessment, curriculum revision, LOT proposal, new or revised course activities to reinforce learning outcomes, etc. Append additional pages if necessary. If appending, include notation in box to "See attached".

With all four outcomes exceeding the minimum performance standard, no adjustments to curriculum or instruction is recommended at this time. Revisions made since the last assessment will continue to be implemented with the goal of at least maintaining the current performance level.

The next time this course is offered, it will run concurrently with its corresponding support section, MTH 102S. Students not placing into college-level math will take MTH 102S as a co-requisite in lieu of taking any developmental courses as a prerequisite. The impact of this change will be monitored and analyzed in the next assessment. Proposed date for the next assessment is Fall 2019.

Assessment Committee Recommendation/Approval
(To be posted by Assessment Committee Chair)

☒ Approved as presented
   Approved with recommendations for future reports (Explanation Required)
   Resubmission Required. Reason for Resubmission:

Date: 02/09/2018

Attachment 1 – Performance Indicators Used for Assessment

Final Exam Review

1.1

Mary purchased 4 tires by mail order. She paid $56.80 per tire plus $6.50 per tire for shipping and handling. There is no sales tax, because the tires were purchased out of state. She also had to pay $8.35 per tire for mounting and balancing. At a local store, Mary's total for the 4 tires with mounting and balancing would be $328 plus 7% sales tax. How much did Mary save by purchasing the tires through the mail?

Mary saved $ 64.36 on the purchase of 4 tires.

2.1

Fill in the blank with the appropriate word.

A mathematical system consists of a set of elements and at least one ____ operation.

A mathematical system consists of a set of elements and at least one   binary   operation.

2.2

Fill in the blank with the appropriate word.

If a binary operation is performed on any two elements of a set and the result is an element of the set, then that set is ____ under the given binary operation.

If a binary operation is performed on any two elements of a set and the result is an element of the set, then that set is   closed   under the given binary operation.

2.3

Is the set of rational numbers a group under the operation of addition?

Is the set of rational numbers a group under the operation of addition? If not, why not? Select all that apply.

  A. Yes, it is a group.

  B. No, it is not a group. There exist rational numbers a and b such that $a + b \neq b + a$.

  C. No, it is not a group. There is at least one rational number that does not have an inverse in the set of rational numbers under the operation of addition.

  D. No, it is not a group. There exist rational numbers a, b, and c such that $(a + b) + c \neq a + (b + c)$.

  E. No, it is not a group. There is no identity element in the set of rational numbers under the operation of addition.

  F. No, it is not a group. The set of rational numbers is not closed under the operation of addition.

2.4

Is the set of negative integers a commutative group under the operation of addition?

Is the set of negative integers a commutative group under the operation of addition? If not, why not? Select all that apply.

- ☐ A. Yes, it is a commutative group.
- ☒ B. No, it is not a commutative group. There is no identity element in the set of negative integers under the operation of addition.
- ☐ C. No, it is not a commutative group. There exist negative integers a and b such that $a + b \neq b + a$.
- ☒ D. No, it is not a commutative group. There is at least one negative integer that does not have an inverse in the set of negative integers under the operation of addition.
- ☐ E. No, it is not a commutative group. The set of negative integers is not closed under the operation of addition.
- ☐ F. No, it is not a commutative group. There exist negative integers a, b, and c such that $(a + b) + c \neq a + (b + c)$.

2.5

Determine the difference in clock 12 arithmetic by starting at the first number and counting counterclockwise on the clock the number of units given by the second number.

$2 - 5$

$2 - 5 = \boxed{9}$

2.6

Assume that Sunday is represented as day 0, Monday is represented by day 1, and so on. If today is Monday (day 1), determine the day of the week it will be at the end of 192 days. Assume no leap years.

It will be a $\boxed{\text{Thursday}}$, 192 days after Monday.

2.7

Determine what number the product is congruent to in mod 3.

$4 \cdot 7$

$4 \cdot 7 \equiv \boxed{1} \ (\bmod \ 3)$

2.8

Find the modulo class to which the number belongs for the indicated modulo system.

18, mod 7

18 belongs to the modulo class $\boxed{4}$ for the modulo 7 system.

2.9

Find the modulo class to which the number belongs for the indicated modulo system.

— 32, modulo 9

The number − 32 belongs to the modulo class 4 for the modulo 9 system.

2.10

Determine all positive number replacements (less than the modulus) for the question mark that make the statement true.

4 · ?≡6 (mod 9)

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

⊘★A. The positive number replacement(s) (less than the modulus) for the question mark is(are) 6 .
(Use a comma to separate answers as needed.)

○ B. There are no positive number replacements (less than the modulus) for the question mark that make the statement true.

2.11

A tennis pro's workout schedule is to have both morning and afternoon practice for 3 days, rest for 1 day, have only morning practice for 2 days, rest for 2 days, and then start the cycle again. If the tennis pro is on her *rest for one day* part of the schedule, determine what she will be doing a) 21 days from today, b) 51 days from today, c) 100 days from today, and d) Will the tennis pro have a day off 75 days from today?

a) What day of the workout schedule will the tennis pro be on 21 days from now?

○ A. Fifth training day of the cycle
○ B. Third rest day of the cycle
⊘★C. First training day of the cycle
○ D. Second rest day of the cycle

b) What day of the workout schedule will the tennis pro be on 51 days from now?

○ A. Third training day of the cycle
○ B. Fourth training day of the cycle
○ C. Fifth training day of the cycle
⊘★D. Second rest day of the cycle

c) What day of the workout schedule will the tennis pro be on 100 days from now?

- ○ A. Fifth training day of the cycle
- ○ B. Fourth training day of the cycle
- ○ C. Second rest day of the cycle
- ⊛ D. Third rest day of the cycle

d) Will the tennis pro have a day off 75 days from now?

- ⊛ Yes
- ○ No

2.12

Fill in the blank with an appropriate word, phrase, or symbol(s).

Probability determined by the relative frequency of occurrence of an event, or actual observations of an experiment is called _____ probability.

Probability determined by the relative frequency of occurrence of an event, or actual observations of an experiment is called   empirical   probability.

2.13

Of the last 60 people who went to the cash register at a department store, 16 had blond hair, 20 had black hair, 19 had brown hair, and 5 had red hair. Determine the empirical probability that the next person to come to the cash register has red hair.

$P(red) = \dfrac{1}{12}$

(Simplify your answer. Type an integer or a fraction.)

2.14

What is the probability of getting either a queen or a seven when drawing a single card from a deck of 52 cards?

What is the probability that the card is either a queen or a seven?

$\dfrac{2}{13}$ (Simplify your answer. Type an integer or a fraction.)

2.15

A die is tossed. Find the odds against rolling a number greater than 2.

The odds against rolling a number greater than 2 are 1 : 2 .
(Simplify your answer.)

2.16

Use the following statement to answer parts **a)** and **b)**. Two hundred raffle tickets are sold for $3 each. One prize of $500 is to be awarded. Winners do not have their ticket costs of $3 refunded to them. Raul purchases one ticket.

a) Determine his expected value.
b) Determine the fair price of a ticket.

a) His expected value is $ -0.50 . (Type an integer or a decimal.)

b) The fair price of a ticket is $ 2.50 . (Type an integer or a decimal.)

2.17

An individual can be classified by gender as male, female, by hair color as black, blonde, brown, red, and by eye color as black, brown, green.

a) How many different classifications are possible (for example, male, with brown hair, and black eyes)?

There are 24 different classifications.

b) Construct a tree diagram to determine the sample space.

The tree for gender has 2 branches.
From each branch of the tree for gender, the tree for hair color has 4 branches.
From each branch of the tree for hair color, the tree for eye color has 3 branches.

c) If each outcome is equally likely, find the probability that the individual will be a female with blonde hair and green eyes.

The size of the sample space is 24 .

The probability of this event is $\dfrac{1}{24}$.

(Type a fraction. Simplify your answer.)

d) Find the probability that the individual will be a male with brown hair.

There are 3 sample points.

The size of the sample space is 24 .

The probability of this event is $\dfrac{1}{8}$.

(Type a fraction. Simplify your answer.)

2.18

What is the probability of getting either a heart or a jack when drawing a single card from a deck of 52 cards?	What is the probability that the card is either a heart or a jack?
	$\dfrac{4}{13}$
	(Simplify your answer. Type an integer or a fraction.)

2.19

Consider a collection of envelopes consisting of 1 red envelope, 3 blue envelopes, 3 green envelopes, and 2 yellow envelopes. If three envelopes are selected at random, without replacement, determine the probability that they are all green envelopes.

The probability that all of the envelopes are green is $\dfrac{1}{84}$.

(Type an integer or a simplified fraction.)

2.20

Angel has 8 DVD movies on a shelf; 5 dramas, 2 science fiction movies, and 1 comedy. Two movies will be selected at random. Determine the probability of each situation below.

a) Selecting at least one drama movie, with replacement
b) Selecting at least one drama movie, without replacement

a) The probability of selecting at least one drama movie, with replacement, is $\dfrac{55}{64}$.

(Type an integer or a simplified fraction.)

b) The probability of selecting at least one drama movie, without replacement, is $\dfrac{25}{28}$.

(Type an integer or a simplified fraction.)

2.21

Consider the figures to the right. Assume that one number from 1 to 7 is equally likely to be selected at random. Each number corresponds to one of the seven figures shown. Find the probability of selecting a triangle, given that an odd number is selected.

(1) △2 3 4 (5) △6 (7)

P(triangle | odd) = 0 (Type an integer or a simplified fraction.)

2.22

240 individuals are asked which evening news they watch most often. The results are shown to the right. If one of these individuals is selected at random, find the probability that the person watches ABN or NBS, given that the individual is a woman.

Viewers	ABN	NBS	SBC	Other	Total
Men	35	10	35	60	140
Women	45	15	10	30	100
Total	80	25	45	90	240

P(ABN or NBS | woman) = $\dfrac{3}{5}$

(Type a fraction. Simplify your answer.)

2.23

License plates in a particular state are to consist of 3 digits followed by 3 uppercase letters.
a) How many different license plates can there be in this state if repetition of letters and numbers is permitted?
b) How many different license plates can there be in this state if repetition of letters and numbers is not permitted?
c) How many different license plates can there be in this state if the first and second digits must be odd, and repetition of letters and numbers is not permitted?
d) How many different license plates can there be in this state if the first digit cannot be 0, and repetition of letters and numbers is not permitted?

a) There are 17,576,000 different possible license plates if repetition of numbers and letters is permitted.

b) There are 11,232,000 different possible license plates if repetition of numbers and letters is not permitted.

c) There are 2,496,000 different possible license plates if the first and second digits must be odd, and repetition of letters and numbers is not permitted.

d) There are 10,108,800 different possible license plates if the first digit cannot be 0, and repetition of letters and numbers is not permitted.

2.24

If a club consists of 9 members, how many different arrangements of president, vice-president, and secretary are possible?

The number of possible arrangements is 504 .

2.25

Jeanine Baker makes floral arrangements. She has 15 different cut flowers and plans to use 7 of them. How many different selections of the 7 flowers are possible?

How many ways can the 7 flowers be chosen?

6435

2.26

Identify the sampling technique used to obtain the following sample.

A state is divided into regions using area codes. A random sample of 40 area code areas is selected.

Choose the correct sampling technique below.

⊛A. Cluster sampling
○ B. Stratified sampling
○ C. Convenience sampling
○ D. Random sampling
○ E. Systematic sampling

2.27

Discuss the statement and tell what possible misuse or misinterpretation may exist.

In a study of patients with cold symptoms, each patient was found to have improved symptoms after taking echinacea. Therefore, echinacea cures the common cold.

Discuss the statement and tell what possible misuse or misinterpretation may exist. Choose the correct answer below.

○ A. The statement is not valid because having improved symptoms does not necessarily translate to the patients being cured of the common cold.
⊛B. The statement is not valid because the patients may have improved on their own without taking echinacea and having improved symptoms does not necessarily translate to the patients being cured of the common cold.
○ C. The statement is valid because each patient had improved symptoms which translates to the patients being cured of the common cold.
○ D. The statement is valid because the patients may have improved on their own without taking echinacea and having improved symptoms translates to the patients being cured of the common cold.

2.28

Use the frequency distribution to determine
a) the total number of observations.
b) the width of each class.
c) the midpoint of the second class.
d) the modal class (or classes).
e) the class limits of the next class if an additional
   class were to be added.

Class	Frequency
7 – 12	2
13 – 18	3
19 – 24	5
25 – 30	9
31 – 36	4
37 – 42	8

The total number of observations is 31 .

The width of each class is 6 .

The midpoint of the second class is 15.5 .
(Type an integer or a decimal.)

The modal class(es) is/are 25 – 30 .
(Use a hyphen to separate the limits of a class. Use a comma to separate answers. Type the classes in order from smallest to largest.)

The class limits of the next class if an additional class were to be added are 43 – 48 .
(Use a hyphen to separate the limits of a class.)

2.29

Use the histogram below to answer the following questions.
a) How many people were surveyed?
b) How many people purchased four soft drinks?
c) What is the modal class?
d) How many soft drinks were purchased?
e) Construct a frequency distribution from this histogram.

There were 29 people who were surveyed.

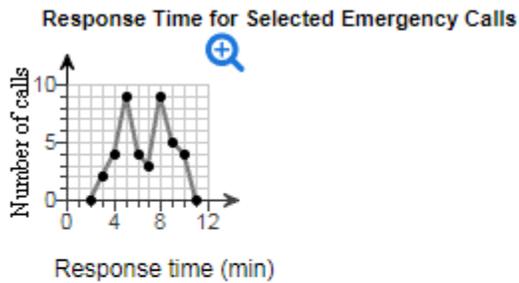There were 5 people who purchased four soft drinks.

The modal class is 2 .

There were 87 soft drinks purchased.

Number of Soft Drinks Purchased at a Theater

Construct the frequency distribution.

Number of Soft Drinks Purchased	Number of People
0	2
1	3
2	7
3	6
4	5
5	4
6	2

2.30

Use the frequency polygon below to answer the questions in parts a) through e).

Response Time for Selected Emergency Calls

Response time (min)

a) The number of calls that were responded to in 5 minutes is 9 .
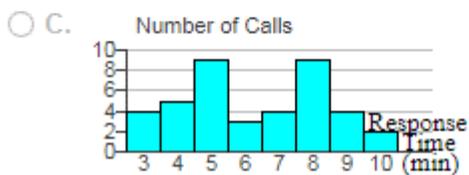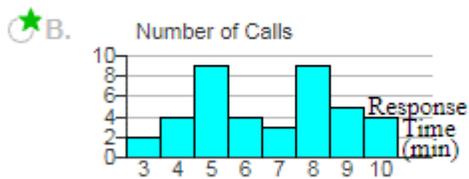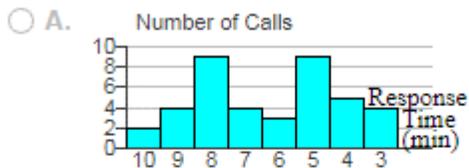
b) The number of calls that were responded to in 6 minutes or less is 19 .

c) The total of number of calls in the survey is 40 .

d) Construct the frequency distribution.

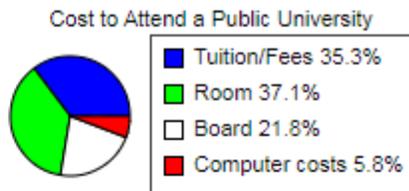| Response Time (min)	Number of Calls
3	2
4	4
5	9
6	4
7	3
8	9
9	5
10	4

e) Choose the correct histogram of the frequency distribution.

○ A.

○ B.

○ C.

2.31

The cost to attend a public university in a recent year is $15,089. The circle graph to the right shows the percentage of that cost for tuition/fees, room, board, and computer costs. Determine the cost, in dollars, for each category.

Cost to Attend a Public University

- ■ Tuition/Fees 35.3%
- ■ Room 37.1%
- □ Board 21.8%
- ■ Computer costs 5.8%

The cost of tuition and fees is $ 5,326.42 .
(Round to the nearest cent as needed.)

The cost of room is $ 5,598.02 .
(Round to the nearest cent as needed.)

The cost of board is $ 3,289.40 .
(Round to the nearest cent as needed.)

The computer costs are $ 875.16 .
(Round to the nearest cent as needed.)

2.32

Using the following values, find the mean, median, mode and midrange.

57, 50, 37, 48, 58, 45, 61

The mean is 50.9 . (Round to the nearest tenth as needed.)

The median is 50 .

Select the correct choice below and fill in any answer boxes within your choice.

- ○ A. The mode is ☐ . (Use a comma to separate answers as needed.)
- ★ B. There is no mode.

The midrange is 49 .

2.33

Find the range and standard deviation of the set of data.

250, 252, 254, 256, 258, 260, 262

The range is 12 . (Simplify your answer.)

The standard deviation is 4.32 .
(Round the final answer to the nearest hundredth as needed. Round all intermediate values to the nearest hundredth as needed.)

2.34

Fill in the blank with an appropriate word, phrase, or symbol.

A distribution in which two nonadjacent values occur more frequently than any other values in a set of data is called a(n) _____ distribution.

A distribution in which two nonadjacent values occur more frequently than any other values in a set of data is called a(n) bimodal distribution.

2.35

Assume that the speed of automobiles on an expressway during rush hour is normally distributed with a mean of 63 mph and a standard deviation of 5 mph. What percent of cars are traveling faster than 72 mph?

⊞ Click the icon to view page 1 of the table of z-scores. ⧉

⊞ Click the icon to view page 2 of the table of z-scores.

The percentage of cars traveling faster than 72 mph is 3.59 %.
(Type an integer or a decimal rounded to two decimal places as needed.)

Final Exam

1.3. A television sells for $750. Instead of paying the total amount at the time of the purchase, the same television can be bought by paying $150 down and $50 a month for 14 months. How much is saved by paying the total amount at the time of the purchase?

1.4. After filling a gas tank the odometer read 82,803.6. After the next filling it read 83,034.6. It took 17.5 gallons to fill the tank. How many miles per gallon did the driver get?

For questions 1-2, fill in the blank with the best word. Choices include

| binary | closed | commutative | group |
| identity | inverse | multiplicative | |

2.1. A mathematical system consists of a set of elements and at least one _____ operation.

2.2. If a binary operation is performed on any two elements of a set and the result is an element of the set, then that set is _____ under the given binary operation.

2.3. Determine whether the negative integers are a commutative group under the operation of addition. If not, give at least one property of a group that is not met.

2.4. If today is Friday, what day will it be 129 days from now?

2.5. Perform the modular arithmetic operation: $(9 \cdot 7) \bmod 7$

2.6. If a single card is chosen at random from a deck of 52 cards, the probability that a spade is selected is 1/4. What does this mean?

      a. It means that if you choose a card at random 4 times, a spade will appear 1 time.
      b. It means that if you choose a card at random many times, about 1/4 of the outcomes will be spades.
      c. It means that if you choose a card at random 52 times, exactly 13 cards will be spades.
      d. A probability of 1/4 tells us nothing.

2.7. Of the last 60 people who went to the cash register at a department store, 10 had blond hair, 19 had black hair, 23 had brown hair, and 8 had red hair. Determine the empirical probability that the next person to come to the cash register has blond hair.

2.8. What is the probability of getting either an ace or a five when drawing a single card from a deck of 52 cards?

2.9. The results of a medical test show that of 75 people selected at random who were given the test, 3 tested positive and 72 tested negative. Determine the odds in favor of a person selected at random testing positive.

2.10. One hundred raffle tickets are sold for $3 each. One prize of $100 is to be awarded. What is the expected value of someone who buys one ticket?

2.11. A couple plans to have three children. Find the probability that the family has exactly two girls. (Hint: You may want to construct a tree diagram and list the sample space.)

2.12. Consider a collection of envelopes consisting of 3 red envelopes, 1 blue envelope, 2 green envelopes, and 3 yellow envelopes. If three envelopes are selected at random, without replacement, determine the probability that they are all yellow envelopes.

2.13. The following table indicates the preference for different types of soft drinks by three age groups.

	Cola	Root Beer	Lemon-Lime	Total
Under 21 years of age	40	25	20	85
Between 21 and 40	35	20	30	85
Over 40 years of age	20	30	35	85
Total	95	75	85	255

If a person is selected at random, find the probability that the person drinks root beer, given that they are under 21 years of age.

2.14. If a club consists of 12 members, how many different arrangements of president, vice-president, and secretary are possible?

2.15. Identify the sampling technique used to obtain the sample: A group of people are classified according to height and then random samples of people from each group are taken.
      a. Random
      b. Systematic
      c. Cluster
      d. Stratified
      e. Convenience

2.16. Seventy-five percent of all dentists recommend Brand X toothpaste. Therefore, this toothpaste is better than all other types of toothpaste. Choose the best response to this statement.
  a. The statement is not valid because a recommended toothpaste may not be better than other types of toothpaste.
  b. The statement is not valid because only seventy-five percent of dentists recommend it. An eighty percent recommendation is required to say that type is better.
  c. The statement is not valid because not all dentists were surveyed.
  d. The statement is valid because if enough dentists recommend it then it must be the best.

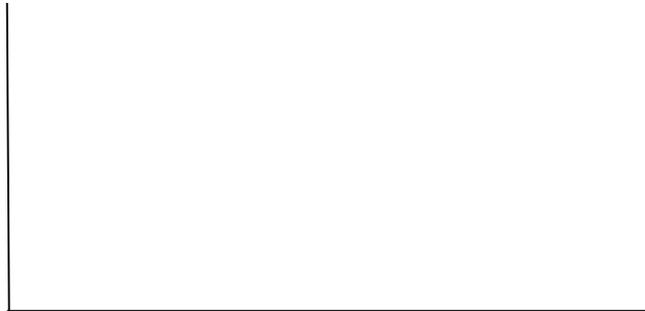**2.17.** Use the given frequency distribution to determine the class width.

Class	Frequency
9-16	6
17-24	9
25-32	7
33-40	7
41-48	2
49-56	1

For questions 18-19, use the following data which represent the total number of years of formal education for 40 employees of a bank.
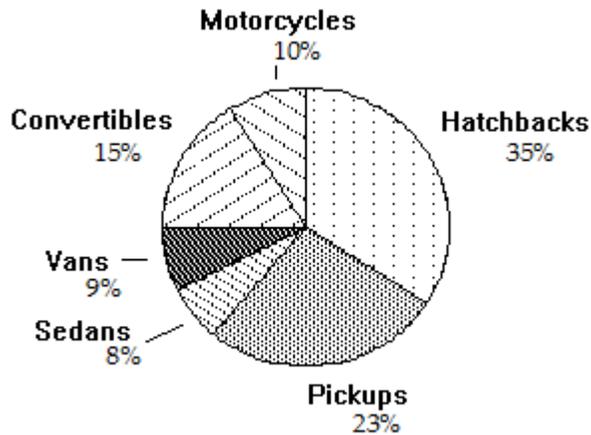
11	13	13	14	15	16	17	18
12	13	13	14	15	16	17	18
12	13	13	14	15	17	17	19
12	13	13	14	15	17	17	19
13	13	13	14	16	17	17	19

2.18. Construct a frequency distribution using a class width of 2.

2.19. Construct a histogram of the frequency distribution.

2.20. A survey of the 4032 vehicles on the campus of State University yielded the following circle graph:

Find the number of sedans. Round to the nearest whole if necessary.

For questions 21-23, use the set of data 53, 45, 32, 43, 53, 40, 56 *and determine the…*

2.21. mean. Round to the nearest tenth if necessary.

2.22. mode. Round to the nearest tenth if necessary.

2.23. standard deviation. Round to the nearest hundredth if necessary.

2.24. A distribution in which all the values have the same frequency is called a _____ distribution.
   a. rectangular
   b. J-shaped
   c. bimodal
   d. skewed
   e. normal

2.25. The average weekly income of teachers in one school district is $725 with a standard deviation of $80. Find the percentage of teachers earning more than $830 a week.