Use your calculator to compute each expression to 6 significant digits accuracy or six decimal places, whichever is more accurate. Write down the sequence of keys you entered in order to compute each expression. Do not round numbers in mid-computation.

1. (4pts) $\sqrt[4]{31} =$

2. (6pts) $22(\sqrt[3]{7.23} - 1) =$

3. (8pts) $2015\left(1 + \dfrac{0.025}{12}\right)^{18} =$

4. (9pts) $\dfrac{3000}{\left(1 + \dfrac{0.035}{2}\right)^{8}} =$

5. (9pts) $12\left(\sqrt[18]{\dfrac{2000}{1200}} - 1\right) =$

6. (12pts) $\dfrac{\left(1 + \dfrac{0.0324}{12}\right)^{24} - 1}{\dfrac{0.0324}{12}} =$

7. (12pts) $\dfrac{1 - \left(1 + \dfrac{0.025}{4}\right)^{-20}}{\dfrac{0.025}{4}} =$

1. (8pts) a) What is 59 percent of 223?   b) 31% of what number is 15?

2. (6pts) You bought a pair of sneakers for $99. If sales tax is 6%(like in Kentucky), what is the total cost?

3. (13pts) Harry and Meghan, a married couple with three children, are filing a single tax return. They earned $80,450 in wages and $815 in interest; they deposited $8000 into a retirement account; they paid $6,000 in mortgage interest, $2,000 in property taxes and $3000 in state income taxes, and donated $450 to charity.
a) Find Harry and Meghan's gross income and adjusted gross income.
b) Use the table 8.1 (2016 marginal tax rates, standard deductions and exemptions) on page 507 of our book to first determine Harry and Meghan's taxable income (don't forget the exemptions) and then find the tax on this income.

4. (13pts) In 2018 a flat screen monitor cost $470. Over the next two years, demand increased, so the price rose 22%. Over the following year, demand dropped, and the price dropped 15% What is the cost of the monitor after three years? Did it increase or decrease compared to cost in 2018, and by how many percent?

5. (10pts) How much money should you deposit in a simple-interest account bearing 4.75% if you would like to have $7500 in thirty months? How much of the final $7500 is from interest?

6. (10pts) Alfred borrowed $4000 on a credit card and repaid it in four months with $4280. What percent simple (annual) interest rate was he paying on this loan?

1. (8pts) Sally would like to have $2000 for a good electric guitar. How much should she deposit now in an account bearing 3.46%, compounded quarterly, in order to have the desired amount in two and a half years? How much of the $2000 came from interest?

2. (6pts) Bank of Guru is offering a 1.33% interest rate on an account that is compounded weekly, while Swami Bank has an account at 1.36%, compounded quarterly. Which account is the better deal?

3. (10pts) Tiana deposited $1500 into an account bearing 3.3%, compounded quarterly. After two years, she needed some money and withdrew $800. How much is in the account five years from her deposit?

4. (10pts) To save for a car in four years (approximate cost $20,000), you make monthly deposits into an account bearing 4.5%, compounded monthly.
a) How much should you deposit every month to reach your goal?
b) How much would you earn in interest over the four years?

5. (16pts) At age 22, Juan inherited a retirement account with $66,000 in it, which he decided to leave alone. At age 29, he found a good job so had money to start adding to the retirement account, depositing $400 every month. Suppose the account grew all the time at rate 8.5%, compounded monthly.
a) How much is in the account when Juan is 45?
b) How much of it was from deposits and inheritance, and how much from interest?

6. (10pts) You bought a shares of stock when they cost $3.56 and sold them in three years at $8.48. Assuming annual compounding, at what annual rate did this investment grow?

This is an exercise in computing the payment on a hypothetical loan and comparing it with the numbers that financial services websites give you. Do the following:

1. (4pts) Decide on an amount and purpose for a hypothetical loan (e.g. buying a car, house, starting a business, etc.) Choose over how many years it should be repaid. Standard choices for each category are suggested: 15, 20, 30 years for a home, 3, 4, 5 years for a car, etc.

2. (14pts) Find a financial services website (bank, mortgage originator) that gives you interest rate quotes for the kind of loan that you chose in problem 1 and computes the monthly payment based on a loan amount. Use their computation to find the monthly payment on your hypothetical loan. **Don't use a website with a "generic" calculator such as bankrate.com, rather, find one that offers actual loans with current interest rates.** Print out the webpage, showing loan amount, term, interest rate and payment and attach it to this one. Try to keep it to just one sheet.

(Attachment)

3. (12pts) Using our loan formula from 8.6, compute (write the computation here) the monthly payment on your hypothetical loan. Use the interest rate that you found on the website. The frequency of compounding is typically monthly. Does your number agree with the information on the website you found?

4. (14pts) Find the balance of the hypothetical loan after two thirds of all payments have been made.

5. (16pts) Write an amortization schedule for the four payments after two thirds of all payments have been made. (For example, if it's a 60-month loan, consider payments 41, 42, 43 and 44.)

1. (15pts) Do this part on your own. Roll two dice 50 times.
a) Record how many times you get each of the possible sums on the dice in the first row.
b) In the second row, enter the empirical probabilities for each sum based on your 50 rolls.
Then compute the theoretical probabilities for each sum and enter them in the third row of
the table. Enter these numbers as fractions.
c) Find the difference between the rows P_E and P_T and write it in decimal form rounded to
4 decimal places, ignoring any minus signs (that is what $|\ |$ stands for).

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
Times occured											
Empirical prob. P_E											
Theoretical prob. P_T											
$|P_E - P_T|$											

2. (15pts) Do this part with 3 classmates. Write their names in the space provided. Each
of you has to fill in the table independently, but the last three rows of this table should be
the same for everyone in your group (check!).
a) Copy the "Times occured" line from above into row "You" and do the same for each of
your classmates.
b) Sum by column and enter the sums in the row "Total times occured".
c) Write the empirical probability for each sum on the dice as a fraction. Keep in mind that
your number of experiments is now larger.
d) Find $|P_E - P_T|$ and write it in decimal form rounded to 4 decimal places. Are the numbers
smaller than in the table above?

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
You											
Total times occured											
Empirical prob. P_E											
$|P_E - P_T|$											

3. (10pts) When choosing an outfit, a regional manager chooses among 4 pants or 7 skirts, 12 shirts, 5 jackets and 9 accessories. Assuming a top and a bottom are mandatory, and a jacket and an accessory optional, and all the outfit elements are independent of each other, how many different outfits can the manager select?

4. (10pts) How many four-digit numbers are there whose sum of digits is a number ending with 3? (For example, 4586 is one such number, $4 + 5 + 8 + 6 = 23$, ends with 3.) Assume the leftmost digit of the four-digit number is not zero.

5. (10pts) A coin is tossed and two dice are rolled.
a) How many different outcomes are there to this experiment?
b) How many different outcomes has the sum on the dice equal to 8?

1. (10pts) Current member states of the European Union have been classified into groups in the table according to their current populations (in millions) and time of joining the union.

Joined EU	Pop. 0–6	Pop. 6-20	Pop. > 20
Before 2000	4	6	4
After 2000	8	4	1

If a random member country of the EU is selected, what is the probability that it
a) joined after 2000?
b) has population greater than 20 million?
c) joined before 2000 and has population below 6 million?
d) joined after 2000 and does not have population between 6 and 20 million?

2. (20pts) Write the probabilities and odds against and in favor of the following events (show any work needed below):

Event	probability	odds against	odds in favor
a) Drawing an ace from a deck of cards			
b) Pulling a red sock without looking from a bag containing 4 red and 7 white socks			
c) Getting exactly one tail on three coin tosses			
d) Drawing a face card or a black 9 from a deck of cards			
e) Getting a sum of 6 or getting a 4 on at least one of the dice on a roll of two dice			

3. (4pts) The odds against Wilma buying a cantaloupe on her weekly visit to the grocery are 7-to-12.
a) What is the probability Wilma buys a cantaloupe on her weekly visit to the grocery?
b) What is the probability Wilma doesn't buy a cantaloupe on her weekly visit to the grocery?

4. (4pts) In a typical year in Seattle, Washington, 42% of days are sunny.
a) What are the odds in favor of choosing a sunny day in Seattle?
b) What are the odds against choosing a sunny day in Seattle?

5. (8pts) Among 65 cars on a dealer's lot, 22 are white, 17 have heated front seats, and 8 are white and have heated front seats. What is the probability that a randomly chosen car from the lot
a) is white or has heated front seats?
b) is neither white nor does it have heated front seats?

6. (14pts) Three dice are rolled: red, white and green. Write the number of outcomes of this experiment and then compute the probability that
a) exactly one of the dice came up with a 5.
b) at least one of the dice came up with a 2.
c) the sum on the red and white dice is 5 or the sum on the white and green dice is 6.

1. (14pts) Avid movie-watcher Martin watches two movies per week. For a movie Martin watches, the likelihood he finds it satisfying is 20%, that he finds it mediocre is 45% and that he finds it disappointing is 35%. Assume Martin's liking of the two movies are independent of each other. What is the probability that
a) The first movie is mediocre and the second is satisfying?
b) Martin finds one movie disappointing and one mediocre?
c) At least one of the movies is mediocre or better?

2. (14pts) Three kids are picked from a group of four 3rd-graders, seven 4th-graders and three 5th-graders. What is the probability that:
a) The second kid is a 4th-grader, given that the first one was a 4th-grader?
b) The first kid is a 3rd-grader, the second a 4-th grader and the third a 5th-grader?
c) All three are not 3rd-graders?
d) At least one is a 5-th grader?

3. (10pts) The table shows the varieties of potato chips on a convenience store shelf with respect to flavoring and the style of frying. What is the probability that a random bag of chips:
a) is kettle-cooked jalapeno?
b) is standard-fried?
c) is plain?
d) is plain, given it is standard-fried?
e) is not vinegar, given it is kettle-cooked?

Type	Standard	Kettle	Total
Plain	10	14	
Jalapeno	6	12	
Vinegar	9	8	
Total			

4. (10pts) A game of chance is played in this way: a player pays $5 and draws a card. If the card is an ace, the player gets $55.
a) Determine the player's expected value.
b) If the player plays this game 39 times, how much do they expect to win or lose?
c) What is the fair price of this game?

5. (12pts) A company issues insurance for people who rent their dwelling, covering damage to the renters' possessions in case of fire or theft. Based on past claims, the company's estimates of chances of annual payouts are in the table.
a) Calculate expected value of a renter's claim.
b) How much should the company charge for a 1-year policy to break even on claim costs?
c) How much should the company charge to make a profit of $70 per policy?

Amount of claim	Probability
0	0.71
500	0.14
2,000	0.08
5,000	0.05
10,000	0.2

Final answers should have accuracy to 6 decimal places. Show some work how medians and means are computed. *Giving only the answer will bring you few points.*

1. (8pts) The campaign of a mayoral candidate would like to find out how much support there is for the candidate and wishes to survey the population. Answer whether each of the following methods will produce a good, bad or questionable random sample and comment why.

a ☐ good   Surveying visitors to a golf course.
  ☐ bad
  ☐ iffy

b ☐ good   Surveying random people from the city's voter lists.
  ☐ bad
  ☐ iffy

c ☐ good   Surveying random people from the phone book.
  ☐ bad
  ☐ iffy

d ☐ good   Surveying shoppers as they exit Kohl's.
  ☐ bad
  ☐ iffy

2. (16pts) Below are grades from a College Algebra exam. Do the following:
a) Construct a grouped frequency distribution with first class 41–45.
b) Draw a histogram for the data
c) Enter a representative value for each interval.
d) Estimate the mean of the data based on the frequency distribution.

53, 70, 76, 82, 77, 63, 60, 78, 69, 99, 89, 43, 59,
60, 73, 55, 65, 66, 74, 88, 73, 83, 83, 97, 68, 53

Class	Frequency	Rep. value

3. (10pts) An amateur meteorologist examines over 12 months how many days in a month it rains over 0.25 in. The numbers are listed below.
a) Find the midrange of the data.   5, 7, 10, 12, 9, 11, 14, 9, 7, 12, 6, 4
b) Find the median of the data.
c) Find the mean of the data.

4. (20pts) Over a year, a movie theater tracks the weekly number of new releases. The numbers are shown below. Do the following:
a) Draw a histogram for the data.
b) Find the midrange of the data.
c) Find the mode of the data.
d) Find the median of the data.
e) Find the mean of the data.

Weekly new releases	Frequency (weeks)
0	4
1	7
2	12
3	15
4	10
5	4

5. (6pts) Construct an example with six numbers 0–10, which satisfies the conditions below. Verify by stating the mean, median and mode for your example.

mean < median < mode

Final answers should have accuracy to 6 decimal places (or 4 decimal places for table-derived answers). Show some work how the mean and standard deviation are computed. *Giving only the answer will bring you few points.*

1. (15pts) A small car repair shop tracks how busy it is by counting how many cars it services each day. The results are below.
a) Find the range of the data.
b) Find the mean of the data.
c) Find the standard deviation of the data.

Cars repaired	Frequency (days)
3	4
4	3
5	10
6	9
7	5

2. (15pts) The longevity of heat pump compressors (time in service until they have to be replaced) has been found to have mean 11 years, with standard deviation 2.5 years. Use the 68-95-99.7 rule (draw a picture) to find the percentage of compressors that lasted:

a) between 8.5 and 11 years

b) under 6 years

c) over 18.5 years

d) between 8.5 and 16 years.

3. (5pts) A survey of 774 adults found that 23% of them have no intention of getting vaccinated against the COVID-19 virus. Find the margin of error of this survey and explain what it means.

4. (5pts) Two students took standardized exams. Student A scored 35 points on an exam with mean 32 and standard deviation 4, and student B scored 63 points on an exam with mean 58 and standard deviation 6. Use z-scores to determine which student did better.

5. (20pts) The speed of vehicles on an expressway during rush hour is normally distributed with mean 64 mph and standard deviation 3 mph. Draw a picture showing which area you are computing as you answer:
a) What percentage of vehicles have speed under 60 mph?
b) What percentage of vehicles have speed above 68 mph?
c) What is the percentile of a vehicle traveling at 55 mph? What does this mean?
d) What is the probability that a random vehicle is driving between 56 and 62 mph?

1. (30pts) Greek gods are considering what scourge to unleash on humanity (because, as it is, we have it so good!). The proposals are Fires, Hurricanes, Pandemic, and Flooding, which the gods rank. They will decide on the scourge based on these rankings.

| Votes	5	2	2	3	8	3	3	1
1st	Fi	Fi	Hu	Hu	Pa	Fl	Fl	Fl
2nd	Pa	Fl	Fl	Pa	Fl	Fi	Hu	Hu
3rd	Hu	Hu	Fi	Fi	Fi	Pa	Fi	Pa
4th	Fl	Pa	Pa	Fl	Hu	Hu	Pa	Fi

a) Which choice wins the vote in a plurality election?

b) Which choice wins the vote in a plurality election with elimination?

c) Which choice is the pairwise comparison winner?

d) Which choice is the winner using Borda's method? Perform the check on the sum of Borda points.

2. (16pts) For each of the following graphs:
a) State and justify whether it has an Euler path.
b) State and justify whether it has an Euler circuit.
c) If it has either an Euler path or a circuit, indicate it on the graph. Use arrows and number the edges to indicate how the Euler path or circuit goes around the graph.
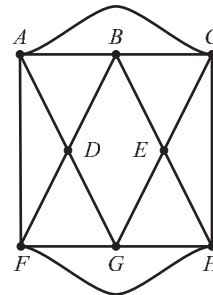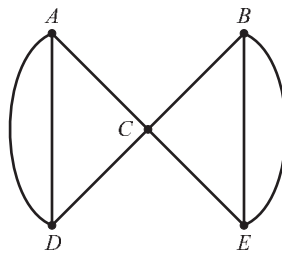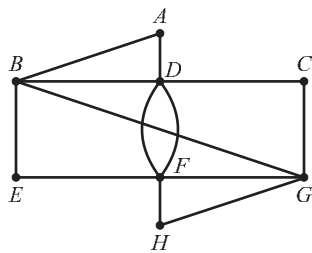
3. (14pts) A mail carrier has to deliver mail to the neighborhood shown in the picture. The mail carrier always walks one row of houses on one side of the street at a time.
a) Draw a graph that models the neighborhood.
b) Can the mail carrier deliver the mail to every house in the neighborhood without walking by any row of houses twice? If so, display the route.