

Mathematics Proficiency test

Answer all the questions and show all work. No credit will be given if no work is shown.
You may use a graphing or scientific calculator.

#1 A urn contains 9 red and 15 blue marbles. Two marbles are picked from the urn (without replacement). What is the probability that:

(a) A red and a blue marble are picked?

(b) Both marbles are of the same color?

#2 Suppose Zoe's chance of getting an item correct on a true on a true/false test is 50%.
What is the probability on a 20-item true/false test that she will get at most 8 items correct?

#3 For the frequency distribution

x	5	6	-3	4	9
f	2	4	2	1	5

find the following:

(a) The sample mean

(b) The sample standard deviation

(c) The sample median

#4 (Modeling with a logistic curve) The number of people that have heard a rumor in a small town, after t days is given by:

$$N = \frac{15000}{(1 + 14999e^{-0.04t})}$$

(a) How many people will eventually have heard the rumor?

(b) When will 5600 people have heard the rumor?

(c) How many people will have heard the rumor after 255 days?

Sketch the graph of this function using the window:

$$x_{min} = 0, x_{max} = 400, y_{min} = 0, y_{max} = 15500.$$

#5 Amelia borrows \$54,500 from a bank that has an APR of 5.9% compounded monthly and plans to pay off the loan in equal monthly installments. If she wants to pay off the loan in 15 years what will her monthly payment be?

#6 One hundred people enter a contest offering scholarships to the first, second and third place winners. In how many ways can the three winners be chosen?

#7 Fish in a given lake have lengths that are distributed normally with mean length 12 inches and standard deviation 2 inches. A fish is chosen at random from the lake. Calculate the probabilities that:

(a) The fish has a length between 11 inches and 13.5 inches.

(b) The fish has a length bigger than 13 inches.

(c) The fish has a length less than 11 inches.

(d) What is the 85th percentile length?

#8 The entrance exam scores of 1000 applicants to a certain college are approximately normally distributed with a mean of 70 and a standard deviation of 9. If the college requires a score of at least 85, how many students' will be rejected on this basis regardless of their other qualifications?

#9 The chances of getting a defective radio is .008. If 295 radios are chosen at random what is the probability that more than 5 are defective?

#10 (a) Construct Pascal's triangle up to the 8th row (the one starting 1, 8, ...).

(b) Using the triangle above, evaluate the following:

(i) $C(8,3)$ —the number of ways of choosing 3 things from 7 things.

(ii) $C(8,4)$

(c) If a set A contains 8 elements, how many subsets of A with 3 elements are possible?

#11 What is the probability of rolling three dice and getting a sum of more than ten?

#12 A city in the US has population as follows for the years given:

<i>YEAR</i>	1750	1790	1800	1830	1850	1890	1940	1970	1985	1995
<i>POP.</i>	6265	13345	19777	22513	29494	169117	395437	581893	772521	915873

Find the equation of the logistic curve that best approximates this data. Use this as a model to predict the population of the city in:

- (a) The year 2009.
- (b) The year 2017
- (c) The year 2119.