

**Louis M. Edwards Mathematics Super Bowl**  
**Valencia Community College -- April 30, 2004**

**Practice Round**

1. The overall average in an algebra class is described in the syllabus as a weighted average of homework, tests, and the final exam. The homework counts 10%, the three tests each count as 20%, and the final counts as 30%. A student in the class has 90 on the homework, and 85, 75, 72 on the three tests. What does the student need to score on the final exam to have an overall average of 80?

Answer \_\_\_\_\_.

2. Given:

If Ron uses Slippery oil, then his car is in good running condition.

Ron's car is in good running condition.

Using Slippery oil costs \$40 per oil change.



Which of these conclusions can be logically deduced?

- a.) Ron spends \$40 per oil change.
- b.) Ron doesn't spend \$40 per oil change.
- c.) You can't determine Ron's oil change costs.
- d.) Ron doesn't use Slippery oil.

Answer \_\_\_\_\_.

3. In 2003 the SAT Math test had a mean of 519. The 2.5<sup>th</sup> percentile was 289 and the 97.5<sup>th</sup> percentile was 749. Assuming the scores have a normal distribution, what is the standard deviation of SAT Math test scores?

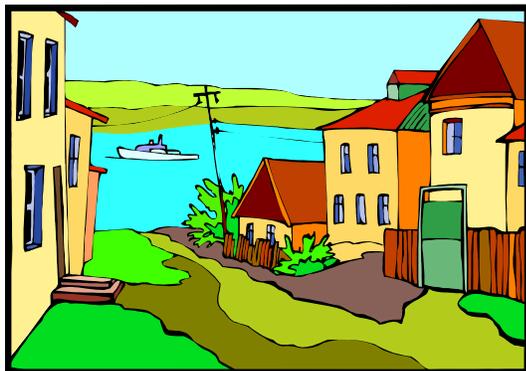
Answer \_\_\_\_\_.



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**Round Two**

1. Suppose that the population of Lakeside was 20000 people on January 1 of year 2000 and was 22000 on January 1 of 2004. Let  $P_E$  be the predicted population on January 1 of year 2010 if an exponential model of growth is used and let  $P_L$  be the predicted population at the same time using a linear model. What is  $P_E - P_L$ ? (round to the nearest unit)

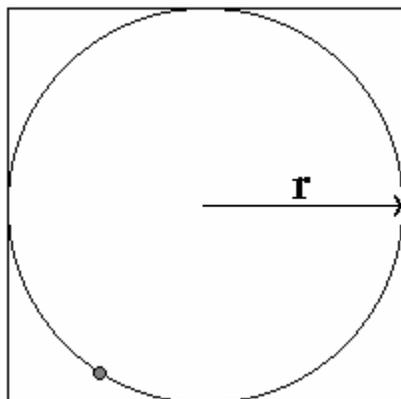


Answer \_\_\_\_\_.

2. An increasing sequence of 100 numbers is such that each number, starting with the second number, is one more than the preceding number. The sum of the 100 numbers is zero. Find the first number in the sequence.

Answer \_\_\_\_\_.

3. A circle is inscribed in a square with vertical and horizontal sides. Given that there is a point on the circle whose distance to the closest vertical side of the square is 9, and whose distance to the closest horizontal side of the square is 2. Find the exact radius of the circle.

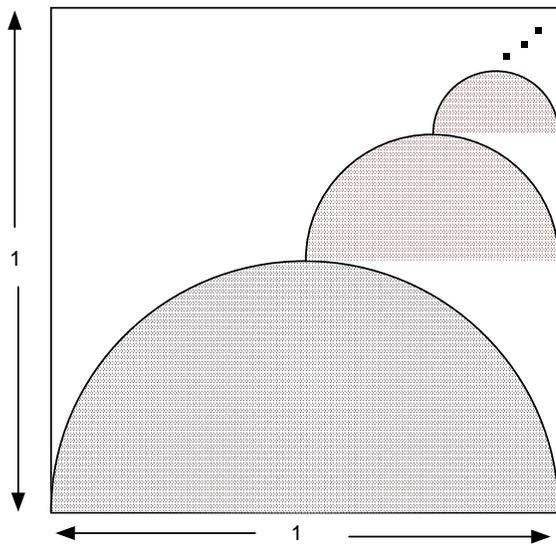


Answer \_\_\_\_\_.

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**Round Three**

1. Semicircles each having one half the diameter of the previous semicircle are inscribed in the unit square indefinitely as shown below. What is the total area of the inscribed semicircles?

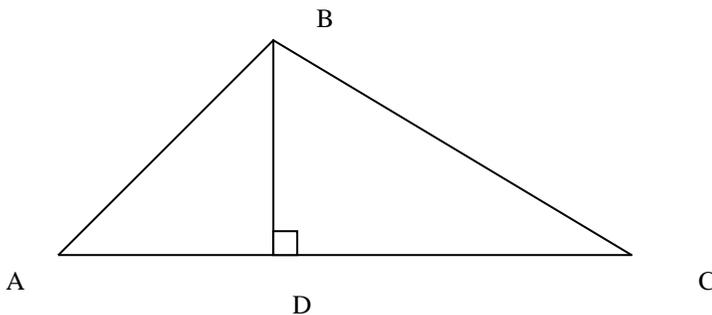


Answer \_\_\_\_\_ sq. units

2. Suppose  $f(x)$  is an even function and  $g(x)$  is an odd function. How many of the following statements are always true?
- $(f+g)(x)$  is an odd function
  - $f(g(x))$  is an even function
  - $(fg)(x)$  is an even function

Answer \_\_\_\_\_

3. For the given diagram, with  $AB=3$ ,  $BC=5$ ,  $AC=7$ , find the exact value of  $BD$ .  
**Error!**



Answer \_\_\_\_\_

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**Round Four**

1. Jose' has a habit of arising before sunrise and wishes to get a pair of matching socks from his dresser drawer without turning on the lights and awaking his significant other. If the drawer contains 12 identical blue socks, 16 identical black socks and 8 identical brown socks how many socks must he take with him to the closet to assure he has a matching pair? (He can then turn the closet light on with the door closed to select an outfit and shoes matching the socks.)



Answer \_\_\_\_\_

2. Find the smallest integer greater than 1 that is simultaneously a perfect square, perfect cube, perfect fourth power, perfect fifth power, perfect sixth power, perfect seventh power, perfect eighth power, and a perfect ninth power. Leave your answer in simplified exponent form.

Answer \_\_\_\_\_

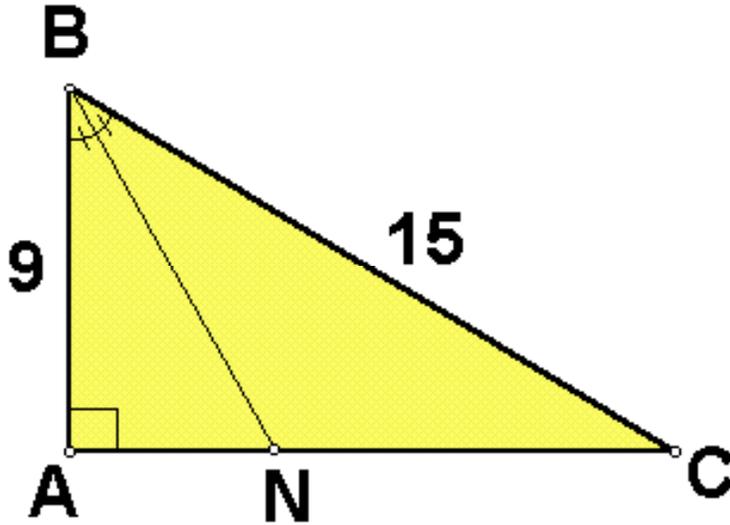
3. The area of a regular decagon is  $A = k s^2$  where  $s$  is the length of one side. Find the value of  $k$  rounded to four decimal places. (Recall that in a regular polygon all sides are equal and all angles are equal.)

Answer       $k =$  \_\_\_\_\_ .

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**Round Five**

1. Find the length of the angle bisector BN in the triangle below.

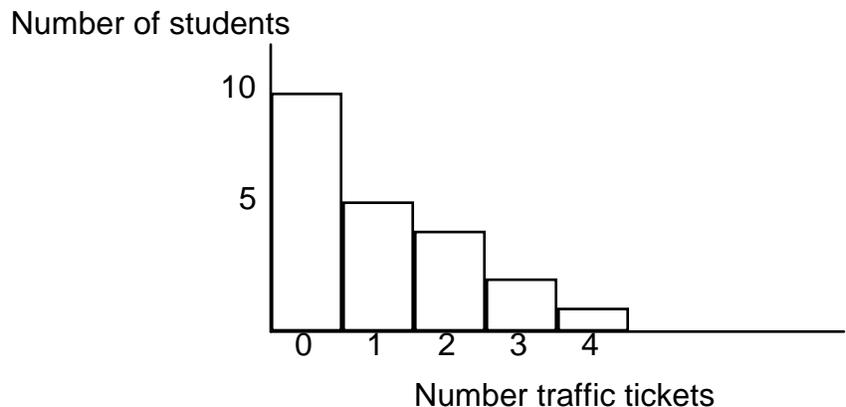


Answer \_\_\_\_\_

2. In a 9 foot wide alleyway with vertical walls on either side, two ladders are positioned so that the foot of each ladder is against one wall and the top of each ladder is resting on the opposite wall. The ladders are 15 feet long and 18 feet long and are positioned so that they are next to each other and form an "X" shape. How far above the ground do the ladders intersect?  
(round your answer to the nearest hundredth of a foot)

Answer \_\_\_\_\_ ft.

3. Twenty-two students in a statistics class were asked how many traffic tickets they had received. The histogram to the right shows the distribution of the data. What is the median of the distribution?



Answer \_\_\_\_\_.

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**Round Six**

1. A circular swimming pool has diameter 50 feet. The depth of the pool along East-West lines is constant. The depth of the pool increases linearly from 3 feet at the South end of the pool to 8 feet at the North end of the pool. Find the exact volume of water in the pool in cubic feet.

Answer \_\_\_\_\_ cubic feet.

2. Four numbers have a sum of 45. If 2 is added to the first, subtracted from the second, multiplied by the third, and divided into the fourth, the results are equal. Find the product of the four numbers.

Answer \_\_\_\_\_.

3. A bag contains 5 red marbles, 3 white marbles and 6 blue marbles. If 4 marbles are randomly chosen from the bag without replacement, find the probability that at least 1 of the marbles is red. (leave your answer in fractional form)



Answer \_\_\_\_\_.

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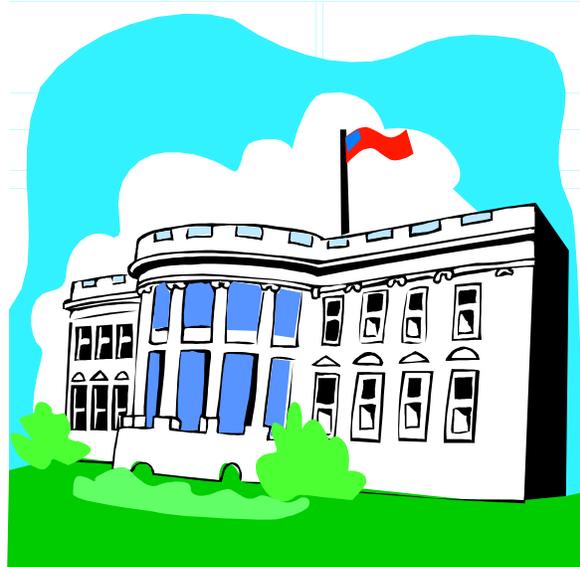
### Group Round - Electing a President

For this group round in addition to two points awarded for each correct answer (one point for "nearly correct" answers), teams with all answers correct receive a bonus of two points (one point for all answers at least "nearly correct"). Additionally, the first team to get all parts correct (not just "nearly correct") will receive an additional bonus of two points and the second team to get all parts correct (not just "nearly correct") will receive a bonus one point. If the points for the time bonus are not awarded due to no teams with all answers correct, they will be awarded to teams with all answers "nearly correct" in the order of submission.

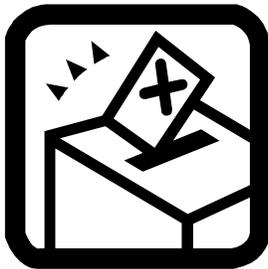
The number of electors for each state is equal to the number of Representatives (1 to 53) plus the number of Senators (2). The 23rd Amendment grants the District of Columbia the number of electors it would be entitled to if it were a state, but not more than that of the least populous state. In 2000, the District received 3 electors. Wyoming, the least populous state, has 3 electors.

The candidate with the highest popular vote tally receives *all* of the state's electoral votes, with the exception of electoral votes from Maine and Nebraska.

In **Maine** and **Nebraska** the 2 at-large electoral votes go to the winner of the statewide popular vote. In addition, the presidential candidate with the highest popular vote in each of the state's Congressional Districts wins 1 electoral vote from that particular district. Maine has been doing this since the 1972 presidential election. Nebraska is a newcomer to this "districting" system of allocating electoral votes to the presidential candidates in the November General Election- having had this in place only beginning with the 1996 election.



The relevant statutes governing this procedure in each state are:



**Maine** Revised Statutes Title 21-A, section 802. Presidential Electors; Representation:

- "One presidential elector shall be chosen from each congressional district and 2 at large"

**Nebraska** Revised Statutes 32-710. State post-primary conventions; selection of presidential electors [excerpt]:

- "One presidential elector shall be chosen from each congressional district, and two presidential electors shall be chosen at large"

Note that on the given table this means that a single voter in Maine or Nebraska is actually accounted for twice in the population of the different "states" one as part of the statewide total and once as part of the district total.

The U.S. Constitution- in Article II, Section 1, clause 2 (which was not altered by the later 12th Amendment)- reads, in part, as follows: "Each State shall appoint, in such manner as the Legislature thereof may direct, a Number of Electors... etc"; it is this constitutional provision which permits the several States to do what Maine and Nebraska have already done in switching over to the "districting" system from the more usual so-called "general ticket" system for allocating electors.

There are a total of 538 electors and 270 votes are needed to elect. Should no candidate receive the necessary 270 votes then the Congress decides the election. The House, voting by states and not as individuals (a majority of the total number of states being necessary to a choice), chooses the President and the Senate, voting by individuals and not as states (a majority of the total number of senators being necessary to a choice), chooses the Vice President.

Using the table of electors and populations and the information provided above determine the following:

- 1.) Assuming the proportion of the population turning out to vote is equal in each state, in a two-person presidential race, what is the smallest proportion of the vote that a candidate could obtain and yet win unanimously in the Electoral College? (round your answer to the nearest one-hundredth of a percent)
- 2.) Assuming the proportion of the population turning out to vote is equal in each state, in a two-person presidential race, what is the smallest proportion of the vote that a candidate could obtain and yet still win in the Electoral College? (round your answer to the nearest one-hundredth of a percent)
- 3.) Assuming the proportion of the population turning out to vote is equal in each state, in a three-person presidential race, what is the smallest proportion of the vote that a candidate could obtain and yet still win in the Electoral College? (round your answer to the nearest one-hundredth of a percent)
- 4.) Assuming the proportion of the population turning out to vote is equal in each state, in a three-person presidential race, what is the largest proportion of the vote that a candidate could obtain and yet still get no votes in the Electoral College? (round your answer to the nearest one-hundredth of a percent)

State	Electors	Percentage of Electors	Population	Percentage of Population
Alabama	9	1.67%	4,461,130	1.58%
Alaska	3	0.56%	628,933	0.22%
Arizona	10	1.86%	5,140,683	1.82%
Arkansas	6	1.12%	2,679,733	0.95%
California	55	10.22%	33,930,798	12.03%
Colorado	9	1.67%	4,311,882	1.53%
Connecticut	7	1.30%	3,409,535	1.21%
Delaware	3	0.56%	785,068	0.28%
District of Columbia	3	0.56%	574,096	0.20%
Florida	27	5.02%	16,028,890	5.68%
Georgia	15	2.79%	8,206,975	2.91%
Hawaii	4	0.74%	1,216,642	0.43%
Idaho	4	0.74%	1,297,274	0.46%
Illinois	21	3.90%	12,439,042	4.41%
Indiana	11	2.04%	6,090,782	2.16%
Iowa	7	1.30%	2,931,923	1.04%
Kansas	6	1.12%	2,693,824	0.96%
Kentucky	8	1.49%	4,049,431	1.44%
Louisiana	9	1.67%	4,480,271	1.59%
Maine (statewide)	2	0.37%	1,277,731	0.45%
Maine (district 1)	1	0.19%	638,866	0.23%
Maine (district 2)	1	0.19%	638,865	0.23%
Maryland	10	1.86%	5,307,886	1.88%
Massachusetts	12	2.23%	6,355,568	2.25%
Michigan	17	3.16%	9,955,829	3.53%
Minnesota	10	1.86%	4,925,670	1.75%
Mississippi	6	1.12%	2,852,927	1.01%
Missouri	11	2.04%	5,606,260	1.99%
Montana	3	0.56%	905,316	0.32%
Nebraska	2	0.37%	1,715,369	0.61%
Nebraska (dist.1)	1	0.19%	571,790	0.20%
Nebraska (dist.2)	1	0.19%	571,790	0.20%
Nebraska (dist.3)	1	0.19%	571,789	0.20%
Nevada	5	0.93%	2,002,032	0.71%
New Hampshire	4	0.74%	1,238,415	0.44%

New Jersey	15	2.79%	8,424,354	2.99%
New Mexico	5	0.93%	1,823,821	0.65%
New York	31	5.76%	19,004,973	6.74%
North Carolina	15	2.79%	8,067,673	2.86%
North Dakota	3	0.56%	643,756	0.23%
Ohio	20	3.72%	11,374,540	4.03%
Oklahoma	7	1.30%	3,458,819	1.23%
Oregon	7	1.30%	3,428,543	1.22%
Pennsylvania	21	3.90%	12,300,670	4.36%
Rhode Island	4	0.74%	1,049,662	0.37%
South Carolina	8	1.49%	4,025,061	1.43%
South Dakota	3	0.56%	756,874	0.27%
Tennessee	11	2.04%	5,700,037	2.02%
Texas	34	6.32%	20,903,994	7.41%
Utah	5	0.93%	2,236,714	0.79%
Vermont	3	0.56%	609,890	0.22%
Virginia	13	2.42%	7,100,702	2.52%
Washington	11	2.04%	5,908,684	2.10%
West Virginia	5	0.93%	1,813,077	0.64%
Wisconsin	10	1.86%	5,371,210	1.90%
Wyoming	3	0.56%	495,304	0.18%
<b>Totals</b>	<b>538</b>	<b>100.00%</b>	<b>281,998,273</b>	<b>100.00%</b>

Some material and assistance in the preparation of this question was obtained from Richard E. Berg-Anderson's material at <http://www.TheGreenPapers.com>.

Answer 1 \_\_\_\_\_ % .

Answer 2 \_\_\_\_\_ % .

Answer 3 \_\_\_\_\_ % .

Answer 4 \_\_\_\_\_ % .