

WSMC High School State Competition

Topical Problems

Part One

April 21, 2007

Directions: Mark on the answer form the letter that is closest to the correct answer. Make sure that your name(s) are on the answer form. If you are on a team put your team number and school name on the answer form. Remember that there are 5 points awarded for a correct response, 1 point for no response, and 0 points for an incorrect response.

Mrs. Finch is considering three different cars for sale at Alpha Car Sales. The Delta model costs 40% more than the Gamma model. The Gamma model is 50% of the Epsilon model. The Epsilon model is \$7,500 more than the Delta. Alpha Car Sales requires 5% down. Alpha Car Sales will finance any car for five years at a 6% APR when paid in monthly payments. Monthly payments are calculated by the formula:

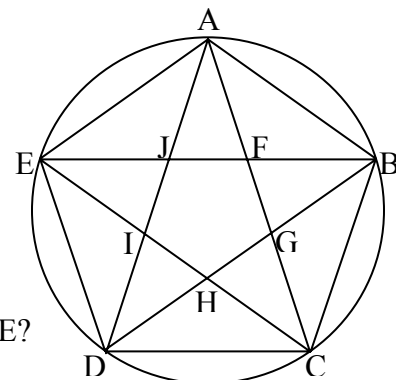
$$payment = \frac{a \cdot \frac{r}{n}}{[1 - (1 + \frac{r}{n})^{-ny}]}$$

a = amount financed, r = interest rate, n = number of payments per year, and y = number of years

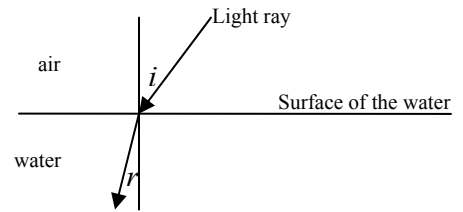
- What is the sum of the prices in thousands of dollars of the three cars that she is considering?
A. 45 B. 35 C. 55 D. 65
- If she has \$900 dollars for a down payment, which car is the most expensive car that she could make the down payment on?
A. Gamma B. Delta C. Epsilon D. none
- If Mrs. Finch was able to make the required 5% down payment on car Gamma, what would be the amount of the monthly payments?
A. 200 B. 220 C. 240 D. 260
- If Mrs. Finch was able to make the required 5% down payment on car Gamma, and financed the rest, How much interest will she have paid in the five years?
A. \$1100 B. \$1300 C. \$1600 D. \$1900

A regular star fits in a circle with a radius of 5 cm as shown.

- Find the measure in degrees of $\angle ADB$.
A. 30 B. 40 C. 60 D. 50
- Find the measure in degrees of $\angle EJA$.
A. 115 B. 120 C. 110 D. 105
- How many other triangles shown are similar to $\triangle AJF$.
A. 9 B. 7 C. 8 D. 5
- Find AB.
A. 5.9 B. 5.6 C. 6.2 D. 5.3
- What is the ratio of the area of pentagon FGHIJ to pentagon ABCDE?
A. 0.20:1 B. 0.15:1 C. 0.30:1 D. 0.25:1



Snell's Law describes the bending of light as it passes from one medium (substance the light is traveling through) to another medium. For example, light passing from air to water bends according to the formula: $\frac{\sin(i)}{\sin(r)} = 1.33$ where i is the angle of incidence (angle

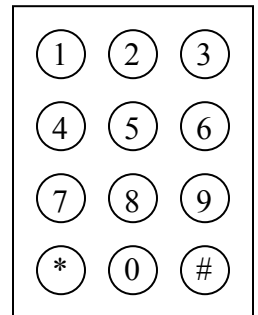


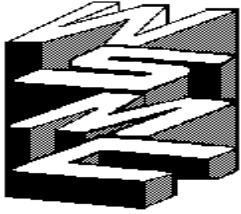
between the perpendicular to the surface the light is passing through) and r is the angle of refraction (the angle made with the perpendicular). 1.33 is called the index of refraction for light passing from light to water.

10. If i is 40° find r in degrees for light passing from air to water.
 - A. 29
 - B. 30
 - C. 31
 - D. 32
11. What is the greatest angle in degrees that r can be for light entering water?
 - A. 49
 - B. 48
 - C. 47
 - D. 46
12. A light ray travels from air into a clear plastic with an i of 50° and r of 30° . For the same situation, what i in degrees would produce an r of 25° ?
 - A. 38
 - B. 40
 - C. 39
 - D. 41

Pictured is a telephone keypad.

13. How many different numbers could start with * and end with one, two or three digits?
 - A. 111
 - B. 1000
 - C. 1100
 - D. 100
14. If the center of any key on the key pad can be a vertex of a triangle, how many different, non-similar, isosceles triangles could be formed using the telephone keypad?
 - A. 5
 - B. 4
 - C. 7
 - D. 6
15. How many different four digit numbers can be entered if each number needs to be diagonally adjacent to the previous number? Of course the first number can be any number including zero.
 - A. 70
 - B. 80
 - C. 90
 - D. 100





Topical Problems

Part Two

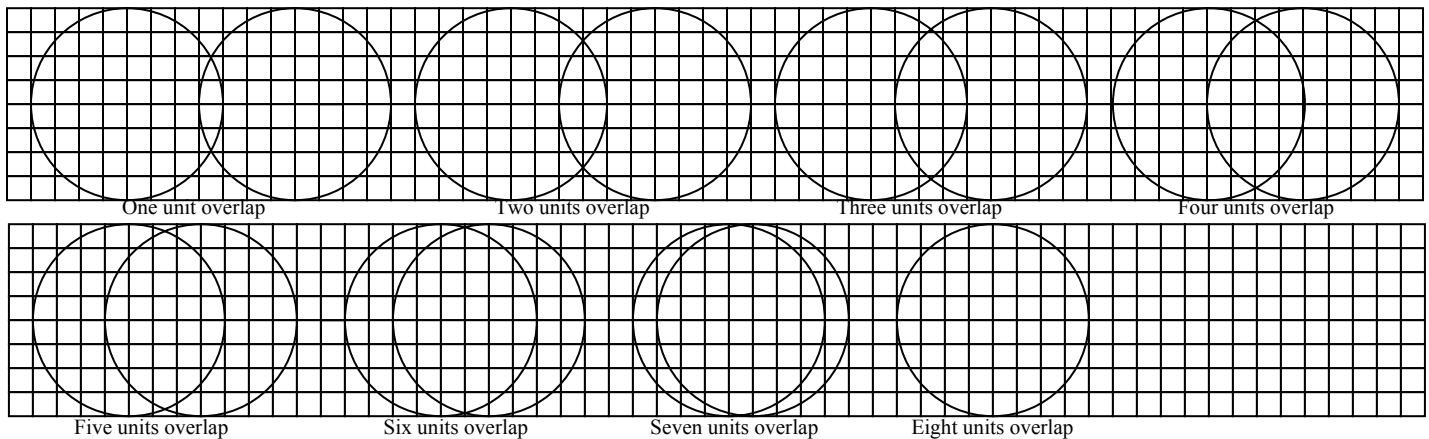
April 21, 2007

Directions: Mark on the answer form the letter that is closest to the correct answer. Make sure that your name(s) are on the answer form. If you are on a team put your team number and school name on the answer form. Remember that there are 5 points awarded for a correct response, 1 point for no response, and 0 points for an incorrect response.

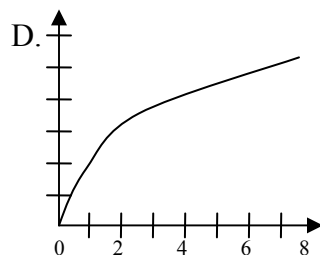
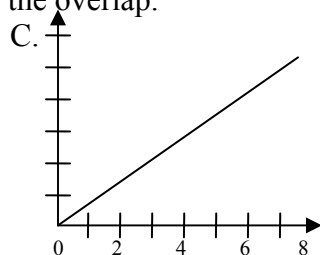
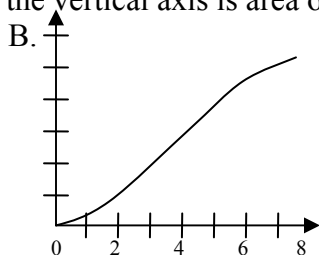
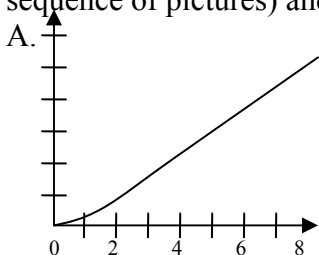
A driver is approaching a stretch of road with speed test signs. There are six signs equally spaced every mile labeled Mile 0, Mile 1, Mile 2, Mile 3, Mile 4, and Mile 5.

- How many minutes will it take a car traveling 50 mph to travel from Mile 0 to Mile 5?
A. 5.0 B. 5.5 C. 6.0 D. 6.5
- What is the speed in mph of a car that takes 4 minutes and 39 seconds to travel from Mile 0 to Mile 5?
A. 67 B. 68 C. 66 D. 65
- If a car travels at 60 mph for the first mile and 50 mph for the second mile, what is the car's average speed for the first two miles in mph?
A. 54.0 B. 55.5 C. 54.5 D. 55.0

The diagram shows two circles both with a radius of 4 units eclipsing each as the earth does the moon.



- Which sketch show one circle eclipsing the other by 25% of the area?
A. Three units overlap B. Four units overlap C. Two units overlap D. Five units overlap
- If the two circles are eclipsing each other in a steady motion (like the earth does the moon), when is the area eclipsed changing the most?
A. one to two unit overlap B. three to four units overlap
C. five to six units overlap D. seven to eight units overlap
- Which graph best show the area overlapped? The horizontal axis is units overlapped (as shown in the sequence of pictures) and the vertical axis is area of the overlap.



Consider a measurement that is given as a number with a certain number of significant digits. Assume this number is a rounding off of the next digit.

7. If the number is 327, what is the smallest value the object measured could be?
 A. 326 B. 327.5 C. 326.5 D. 326.9
8. What is the percentage error the measurement 4.206 m could have?
 A. 0.03% B. 0.04% C. 0.02% D. 0.01%

The table shows the results when a school's Sophomores, Juniors, and Seniors select their favorite subject from math/science, social studies, or language arts.

	Math Science	Social Studies	Lang. Arts
Soph's	45	22	38
Juniors	26	32	29
Seniors	35	30	43

9. What is the probability that a student chosen at random selected math/science?
 A. 0.34 B. 0.35 C. 0.33 D. 0.36
10. What is the probability that a student chosen at random selected social studies or is a senior?
 A. 0.55 B. 0.60 C. 0.50 D. 0.65
11. What is the probability of a person chosen at random selected language arts given they were a junior?
 A. 0.35 B. 0.30 C. 0.15 D. 0.10

A company decided to produce PLD (Personal Listening Device). They estimated that research, development, and production set-up costs would be about \$10,000,000. Marketing's research learned that a price of \$1000 would produce a demand for about 500 units. Marketing also learned that for every \$100 drop in price doubled the demand. Production believes that they can produce the units for \$15 each for quantities of 1500 or more.

12. What would be the predicted demand for a price of \$250?
 A. 120,000 B. 100,000 C. 90,000 D. 80,000
13. Which formula best represents the predicted price based on the description?
 A. $Q = -0.001 P^3 + 2.4 P^2 - 1,714 P + 400,000$ B. $Q = 512,000(1.0069)^{-P}$
 C. $Q = 195,000,000,000 P^{-2.72}$ D. $Q = 25,000,000/(P - 50) - 30,000$
14. What is the net profit if the price is set at \$299.99?
 A. \$7,000,000 B. \$6,000,000 C. \$8,000,000 D. \$10,000,000
15. If the company sets the price for maximum profit, what is the expected profit in millions of dollars?
 A. 13.8 B. 14.2 C. 14.4 D. 14.7

Answer Key State Topical April 21, 2007

Part One		Part Two	
1.	A \$45,000	1.	C 6.0
2.	B Delta	2.	D 64.5
3.	B \$229.58	3.	B 54.54
4.	D \$1900	4.	A
5.	B 36	5.	D
6.	C 108	6.	A
7.	A 9	7.	C 326.5
8.	A 5.88	8.	D 0.012%
9.	B 0.146:1	9.	B 0.35
10.	A 28.9°	10.	A 0.54
11.	A 48.75°	11.	A 0.33
12.	B 40.35°	12.	C 90,510
13.	C 1110	13.	B
14.	D 6	14.	C \$8,240,000
15.	D 96	15.	C \$14,500,000

Answer Key State Topical April 21, 2007

Part One		Part Two	
1.	A \$45,000	1.	C 6.0
2.	B Delta	2.	D 64.5
3.	B \$229.58	3.	B 54.54
4.	D \$1900	4.	A
5.	B 36	5.	D
6.	C 108	6.	A
7.	A 9	7.	C 326.5
8.	A 5.88	8.	D 0.012%
9.	B 0.146:1	9.	B 0.35
10.	A 28.9°	10.	A 0.54
11.	A 48.75°	11.	A 0.33
12.	B 40.35°	12.	C 90,510
13.	C 1110	13.	B
14.	D 6	14.	C \$8,240,000
15.	D 96	15.	C \$14,500,000