

Bergen County Mathematics League

Good Luck To You



Good Luck To All

Contest #3 (No Calculators)

2014-2015

Part I *Time Limit: 12 minutes*

On contests #4 and #6, *any S.A.T. calculator will be allowed.*

3-1. Determine, in simplest form, the value of the binomial expansion

$$86^5 - 5(86)^4(87) + 10(86)^3(87)^2 - 10(86)^2(87)^3 + 5(86)(87)^4 - 87^5.$$

3-2. What are both integral values of x which satisfy

$$\frac{1}{x^2 + 2x - 3} + \frac{18}{x^2 + 2x + 2} - \frac{18}{x^2 + 2x + 1} = 0?$$

Part II *Time Limit: 12 minutes*

3-3. What are all ordered pairs of integers (x,y) for which $(x + y)^2 = x^2 + y^2 + 2?$

3-4. What are all ordered pairs of positive integers (m,n) which satisfy $\frac{4}{m} + \frac{2}{n} = 1?$

Part III *Time Limit: 12 minutes*

3-5. Assuming that the Earth is a sphere with a radius of 4000 miles, how far is it, in miles, from an astronaut seated in a horizontal spacecraft 100 miles from the Earth's surface, to the Earth's visible horizon? [**Hint: Draw a diagram.**]

3-6. The yearly salary increments received by a man equal the yearly salary increments received by his son. The man now earns (yearly) 50% more than his son earned when the man earned what his son earns now. When the son earns what the man now earns, their combined salary will be \$117,000. How many dollars does the man now earn?

Reminder: A question next meet will repeat the theme of question 3-1 (but **THEORETICALLY**).

Answers

3-1. -1

3-2. -4, 2

3-3. (1,1), (-1,-1)

3-4. (12,3), (8,4), (6,6), (5,10)

3-5. 900 or 900 miles

3-6. 54 000 or \$54 000