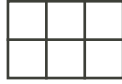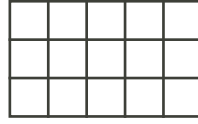# 2007 Fryer Contest (Grade 9)
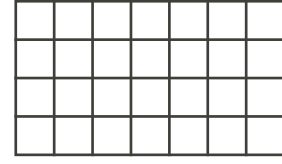## Wednesday, April 18, 2007

1. Squares measuring 1 by 1 are arranged to form the following sequence of rectangles:

Rectangle 1   Rectangle 2   Rectangle 3

Many more rectangles are drawn, with each rectangle having one more row and two more columns than the previous rectangle.

   (a) How many 1 by 1 squares would there be in Rectangle 4? Explain how you obtained your answer.

   (b) Determine the perimeter of Rectangle 4. Explain how you obtained your answer.

   (c) Determine the perimeter of Rectangle 7. Explain how you obtained your answer.

   (d) Rectangle n has a perimeter of 178. Determine n. Explain how you obtained your answer.

2. At last week's hockey game involving the Waterloo Blueberries, the price of a platinum ticket was \$25, the price of a gold ticket was \$10, the price of a silver ticket was \$5, and the price of a bronze ticket was \$1.

   (a) Jim buys 5 platinum tickets, 2 gold tickets and 3 silver tickets. Determine the average cost of the tickets that Jim buys. Explain how you obtained your answer.

   (b) Mike buys 8 tickets whose average cost is \$12. He then buys five more platinum tickets. What is the new average cost of the tickets that he has bought? Explain how you obtained your answer.

   (c) Ophelia buys 10 tickets with an average cost of \$14. Suppose that she buys n more platinum tickets. The new average cost of the tickets that she has bought is \$20. What is the value of n? Explain how you obtained your answer.

3. (a) A number is divisible by 8 if the number formed by its last 3 digits is divisible by 8. For example, the number $47\,389\,248$ is divisible by 8 because 248 is divisible by 8. However, $47\,389\,284$ is not divisible by 8 because 284 is not divisible by 8.

   If $992\,466\,1A6$ is divisible by 8, where A represents one digit, what are the possible values of A? Explain how you obtained your answer.

   (b) A number is divisible by 9 if the sum of its digits is divisible by 9. For example, the number $19\,836$ is divisible by 9 but $19\,825$ is not.

   If $D\,767\,E89$ is divisible by 9, where D and E each represent a single digit, what are the possible values of the sum $D + E$? Explain how you obtained your answer.

   (c) The number $5\,41G\,507\,2H6$ is divisible by 72. If G and H each represent a single digit, what pairs of values of G and H are possible? Explain how you obtained your answer.

4. (a) In the diagram, $\triangle XYZ$ is right-angled at X, with $YX = 60$ and $XZ = 80$. W is the point on YZ so that WX is perpendicular to YZ. Determine the length of WZ. Explain how you obtained your answer.
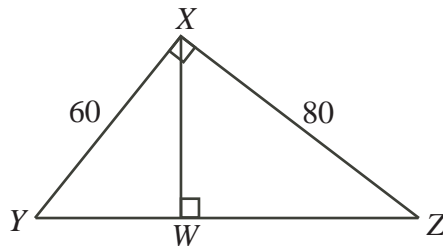
(b) Five points A, B, C, D, and O lie on a flat field. A is directly north of O, B is directly west of O, C is directly south of O, and D is directly east of O. The distance between C and D is 140 m. A hot-air balloon is positioned in the air at H directly above O. The balloon is held in place by four ropes HA, HB, HC, and HD. Rope HC has length 150 m and rope HD has length 130 m. Determine how high the balloon is above the field (that is, determine the length of OH). Explain how you obtained your answer.
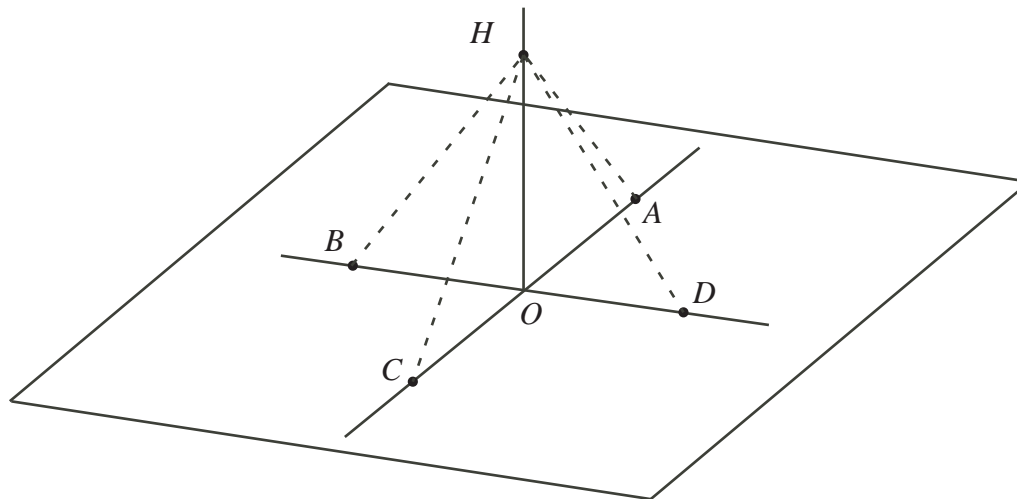
(c) To reduce the total length of rope used, rope HC and rope HD are to be replaced by a single rope HP where P is a point on the straight line between C and D. (The balloon remains at the same position H above O as in part (b).) Determine the greatest length of rope that can be saved. Explain how you obtained your answer.