Problem of the Week
Problem B and Solution
And the Winner Is...

Problem

Winners in the Roll Down the Brim contest at Tom Hinton's have to answer skill testing questions in order to claim the grand prizes of cars, TVs, or $5000 cash. You and a friend decide to try some of the questions, but you keep getting different answers.
For each question, decide which answer is correct, and explain why.

a) Is the value of $6 + 8 \div 2 - 5$ equal to 5, or is it equal to 2?

b) Is the value of $7 \times 4 + 12 \div 2$ equal to 20, or is it equal to 34?

c) Is the value of $12 - 6 + 9 \div 3$ equal to 5, or is it equal to 9?

d) Having calculated the value of $16 + 4 \times 3 \div 6 + 4 \times 3$, you got an answer of 30. But your friend got 42. Which answer is correct? Explain how each answer was obtained.

Solution

When evaluating expressions with a mixture of operations, multiplication and division are done before addition and subtraction, and in the order they appear from left to right.

a) The correct order of operations does the division first so $6 + \underline{8 \div 2} - 5$ simplifies to $6 + \underline{4} - 5$. Then we do addition and subtraction in the order they appear producing an answer of 5. We can write this using brackets as follows:

$$6 + (8 \div 2) - 5 = 6 + 4 - 5 = 5.$$

From this point on in the solution, we will use round brackets to show the parts that will be completed next.

b) The correct order of operations gives $(7 \times 4) + (12 \div 2) = 28 + 6 = 34$.

c) The correct order of operations gives $12 - 6 + (9 \div 3) = 12 - 6 + 3 = 9$.

d) If the correct order of operations is used, the answer is

$$16 + (4 \times 3) \div 6 + (4 \times 3) = 16 + (12 \div 6) + 12 = 16 + 2 + 12 = 30$$

The incorrect answer was done as

$$(16 + 4) \times (3 \div 6) + 4 \times 3 = 20 \times \frac{1}{2} + 4 \times 3 = (10 + 4) \times 3 = 14 \times 3 = 42$$