Sum of Squares

There is a general idea about adding squares. There is no real factorization of the sum of two squares as there is with the difference of two squares. The sum of squares questions that appear on the Number Sense tests usually take one of two forms.

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1 $a^2 + b^2$ where b is Three Times a

A typical problem of this type is $12^2 + 36^2$. This form of problem involves adding two squares where one of the numbers being squared is three times the other number being squared. The trick for this problem involves factorization and exponents. From algebra, we know

$$a^2 + (3a)^2 = a^2 + 9a^2 = 10a^2.$$

Therefore, the trick is to square the smaller number, and multiply it by 10 (move the decimal one place to the right).

Example:
$12^2 + 36^2 =$

Multiply $10 \times 12^2 = 10 \times 144 = 1440$.
$12^2 + 36^2 = 1440$.

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2 $a^2 + b^2$ where b is Two Times a

A typical problem of this type is $17^2 + 34^2$. This form of problem involves adding two squares where one of the numbers being squared is twice the other number being squared. This trick is similar to the trick above. From algebra, we know

$$a^2 + (2a)^2 = a^2 + 4a^2 = 5a^2.$$

Thus, the trick is to multiply 5 times the smaller number squared. An easy trick for multiplying by 5 is to multiply by 10 and divide by 2. Moving the decimal point one place to the right takes care of the multiplying by 10.

EXAMPLE:
$17^2 + 34^2 =$

Add a zero to the end of 17^2:   2890.
Find $2890 \div 2$.
$2890 \div 2 = 1445$.

$17^2 + 34^2 = 1445$.

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3   Similar Problems

Similar problems to the ones above can be created, but most would require difficult multiplication. One problem exists that is actually easier than the two above. When the problem is in the form $a^2 + (7a)^2$, the result is $50a^2$ and multiplication by 50 is simple.

EXAMPLE:
$8^2 + 56^2 =$

$8^2 + 56^2 = 8^2 + (7 \cdot 8)^2 = 8^2 + 7^2 \cdot 8^2 = 8^2(1 + 49) = 8^2(50) = 64(50) = 3200$.
$8^2 + 56^2 = 3200$.