MATHCOUNTS® Problem of the Week Archive

Prime Number Sense – December 3, 2018

Problems & Solutions

If n is the sum of three consecutive primes and is also the product of two 2-digit primes, what is the least possible value of n?

Let's try the two 2-digit primes of least value, 11 and 13. These primes have a product of 143, and 143/3 is around 47. Two primes close in value to 47 are 43 and 53. So we try the sum 43 + 47 + 53 and see that it does, in fact, equal ***143****.*

If p is the sum of three consecutive primes and also is the square of a prime, what is the least possible value of p?

Since three consecutive primes can't have an even sum, we know p is not 4. So let's take a look at the squares of the primes beginning with the prime number three.

$3^2 = 9$ and 9/3 is 3 but $2 + 3 + 5 \neq 9$

$5^2 = 25$ and 25/3 is close to 7 but $5 + 7 + 11 \neq 25$

*$7^2 = 49$ and 49/3 is close to 17 and $13 + 17 + 19$ does = **49**.*

Three consecutive primes, **with values less than 200**, have a sum equal to the product of two other primes that have a difference of 34. What is the value of the greatest of the three consecutive primes?

Let's first find a pair of primes that differ by 34.
$3 + 34 = 37$, another prime. $3 \times 37 = 111$ and 111/3 is 37 but $31 + 37 + 41 \neq 111$
$5 + 34 = 39$, not prime.
$7 + 34 = 41$, another prime. $7 \times 41 = 287$ and 287/3 is close to 97 and $89 + 97 + 101 = 287$.
The greatest of the three consecutive primes is ***101****.*

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