# Problem 49

The arithmetic sequence, 1487, 4817, 8147, in which each of the terms increases by 3330, is unusual in two ways: (i) each of the three terms are prime, and, (ii) each of the 4-digit numbers are permutations of one another.

There are no arithmetic sequences made up of three 1-, 2-, or 3-digit primes, exhibiting this property, but there is one other 4-digit increasing sequence.

What 12-digit number do you form by concatenating the three terms in this sequence?

## Solution

In[46]:=
```
prims = Prime[Range[PrimePi[1000] + 1, PrimePi[10 000]]];
```

We collect the primes together based on whether they are permutations of each other.

In[61]:=
```
gathered = GatherBy[prims, Sort[IntegerDigits[#]] &];
```

In[58]:=
```
refined = Select[gathered, Length[#] > 2 &];
```

Now we just need to go over all of the list refined, looking for arithmetic progressions of length 3 in each sub-list.

In[59]:=
```
progressionQ[{a_, b_, c_}] := (c - b) == (b - a)
```

In[60]:=
```
Select[Subsets[#, {3}], progressionQ] & /@ refined // DeleteDuplicates
```

Out[60]=
```
{{}, {{1487, 4817, 8147}}, {{2969, 6299, 9629}}}
```