PFS 23-2 10/1/09 _____

Design a One-Room Schoolhouse!

Okay, time to go to work! You've been asked to design a one-room schoolhouse for about ten to fifteen students, grades one to eight. You really have two jobs. One is to do some thinking and planning about the school. How big should it be? What shape? How many doors and windows? Do you want to include a bathroom and a kitchen in your design? The second job is to think about how to present your ideas. You need to include a description in writing, and at least one scale drawing.

1) Describe your schoolhouse in one paragraph or more.

2) Make a floor plan of your schoolhouse, showing doors(s) and windows, and important pieces of furniture. Indicate the scale of your drawing. For example, you might choose a scale of 1 cm = 1 ft. Drawing on a blank sheet of paper placed over a sheet of cm graph paper might help. Indicate which direction is north in your floor plan.

3) Make one or more elevations of your schoolhouse. These are scale drawings showing one wall from the outside. You might also want to show an interior elevation, showing windows, bulletin boards, cabinets, and other features.

4) Can you make a perspective drawing of your schoolhouse?

5) Would you like to make a site plan, showing your schoolhouse and the surrounding area?

6) Sometimes architects make three-dimensional models of their plans. If you're feeling ambitious...

7) How about adding detailed drawings of any special features. For example, some classrooms have a loft area.

Have fun working!

PFS 23-2 Alternative 10/1/09 _____

Gaps between Primes

On a ten-by-ten grid write the numbers from one to a hundred and circle the primes. Where is the biggest gap between prime numbers? How long is it? (We're defining "gap" to mean the number of composite numbers in a row. So the gap between seven and eleven is three.) If we did the same job up to a thousand, do you think we'd find bigger gaps? As we go higher and higher, do you think there's ever a gap with 100 composites in a row? How about 1,000 numbers without a prime? Could we find a gap of a million or a trillion numbers with no primes?

Surprisingly, the answer is that gaps between primes can be as large as any number you can name. And you can prove this yourself using something you've probably already learned about: factorials. (Reminder: 5! (pronounced "five factorial") = 5 x 4 x 3 x 2 x 1.))

Here are some hints for a proof: Think of the number 20! Is 20! on the two times table? Is it divisible by three? Is it a multiple of four? Is five one of its factors? How about nineteen? Now think of the number 20! + 2. Can you be sure it's a multiple of two, and therefore a composite? What times table must 20! +3 be on? How can you be sure 20! +4 is composite? How do we know 20! + 19 isn't prime? So how long a gap can we be sure of starting at 20! +2?

1) Write a proof that the gap between prime numbers can be as big as you want!

2) Can you write the same proof, but using primorials? (For example, 11# ("Eleven primorial") = 11 x 7 x 5 x 3 x 2.)

3) By the way, a primorial prime is one that is one away from a primorial. For example, 5# + 1 = 31, and that's a prime. Can you find other primorial primes?

Work hard! Have fun!