

You may not use a calculator on the test. You will be expected to clearly show your work for all problems.

Correct spelling matters. Be prepared to correctly spell the names of the 4 numeration systems we have studied.

1. Name one number, higher than 20, which is both square and triangular.
2. Write the first 7 rows of Pascal's Triangle.
3. Use the partial sums method to add: $355 + 1259 + 151$ (please do the problem vertically)
4. Use the partial sums method to add: $1894 + 5189 + 1078$ (please do the problem vertically)
5. Of the 4 numeration systems we have studied, which system(s) use(s) place value?
6. Of the 4 numeration systems we have studied, which system(s) use(s) a zero?
7. Of the 4 numeration systems we have studied, which system(s) involved powers of ten?

8. Indicate whether each statement is true or false:
 - a. All triangular numbers are counting numbers.
 - b. The answer to any handshake problem is a square number.
 - c. The Egyptian numeration system did not need a zero.
 - d. Our numeration system is called the Four Corners numeration system.
 - e. The Roman numeration system did not use place value.
 - f. The Egyptian numeration system used a style of writing called cuneiform.
 - g. $\frac{7389 \cdot 7388}{2}$ is the answer to a handshake problem.
 - h. The Babylonian numeration system involves powers of ten.
 - i. Writing 999 requires the most symbols if you use the Babylonian numeration system (as compared to the other systems we have studied).
 - j. The sum of any two square numbers is a triangular number.
 - k. The sum of any two triangular numbers is a square number.
 - l. Numbers in bases other than 10 are used only on other planets (and not here on Earth).

9. Briefly describe how the Place Value Game, Krypto, Split Screen, Closer to 100, and Aces Up are played. Also, comment on the mathematics that is used in each activity and the grade level(s) for which the activity may be appropriate.

10. Briefly describe the main disadvantage of the Babylonian numeration system. Be sure to give an example of a number which highlights the disadvantage.

11. List the next 20 numbers in each indicated base:

1101_2

3544_6

1423_5

87_9

12. Convert, as indicated:

a) $1101010_2 = \underline{\hspace{2cm}}_{10}$

b) $1032_4 = \underline{\hspace{2cm}}_{10}$

c) $3014_5 = \underline{\hspace{2cm}}_{10}$

d) $343_{10} = \underline{\hspace{2cm}}_5$

e) $99_{10} = \underline{\hspace{2cm}}_2$

- $312 = \underline{\hspace{2cm}}$ (Babylonian)
 $1579 = \underline{\hspace{2cm}}$ (Roman)
 $968 = \underline{\hspace{2cm}}$ (Roman)
 $2010 = \underline{\hspace{2cm}}$ (Roman)
 $802 = \underline{\hspace{2cm}}$ (Babylonian)
 $36,753 = \underline{\hspace{2cm}}$ (Babylonian)
 $9612 = \underline{\hspace{2cm}}$ (Babylonian)
 $4845 = \underline{\hspace{2cm}}$ (Babylonian)
 $351 = \underline{\hspace{2cm}}$ (Babylonian)
 $792 = \underline{\hspace{2cm}}$ (Babylonian)
 $8523 = \underline{\hspace{2cm}}$ (Babylonian)
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15. Add, writing each answer in the same base as that of the addends:

$$1442_5 + 240_5 + 3434_5$$

$$122_3 + 2022_3 + 112_3$$

$$14425_7 + 2540_7 + 45434_7$$

16. The NCAA Division I Women's soccer tournament will begin in a couple of months. If all 32 head coaches of all the teams in the tournament shake hands, how many handshakes will occur? Solve the problem **using two different strategies**. Clearly show your work.
17. List Polya's steps for problem solving.
18. List any three problem solving strategies on the list we have developed in class so far.
19. Is 1830 a triangular number? Show how you can find out the answer without writing down a huge list of triangular numbers.
20. Is 5151 a triangular number? Show how you can find out the answer without writing down a huge list of triangular numbers.