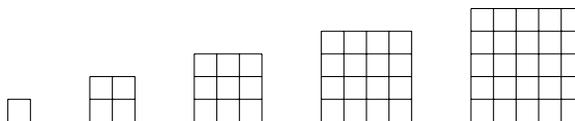


Problem 1: The following parts are all related.

- a. Define *triangular numbers* by construction, starting with the first. Include a formula for the n th triangular number.

Score: /2

- b. Consider the pattern of square numbers below:



Express each square number as the sum of two triangular numbers by drawing directly on each grid.

Score: /2

- c. When you add the n th triangular number with the $(n + 1)$ st triangular number, what would the sum be? Express it in terms of n . Hint: Study smaller examples to see the pattern.

Score: /3

Problem 2: A pipe 100 cm long is cut into two pieces. The longer one is 9 cm longer. How long is the shorter?

Score: /2

Problem 3: Mount Azteca is 1.3km high. There are three different trails from the starting place at the bottom to the top of the mountain. One trail is 4.5km long, another is 3.5km long, and the most difficult is 2.4km long. For each computation below, complete the story problem started so that your problem could lead to the computation described.

a. $(4.5 + 3.5) - (2 \times 2.4)$

b. $4.5 \div 1.3$

Score: /4

Problem 4: Consider the sets, $A = \{1, 3, 5, 7, 9\}$ and $B = \{3, 4, 5, a, b, c, d\}$ in a universe, $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e\}$.

a. Draw a Venn diagram for these sets.

b. Find $A \cap \overline{B}$.

c. Find $U \setminus (B \cup A)$.

d. Find $|A \times B|$.

Score: /4

Problem 5: Out of all our 28 students in Math 190, suppose 25 own laptops and 26 own cellphones, answer the following:

a. Draw a Venn diagram to illustrate the maximum number of students in the class without a laptop and without a cellphone.

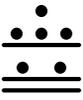
b. Draw a Venn diagram to illustrate the minimum number of students owning both laptops and cellphones.

Score: /4

Problem 6: Convert the following numbers to Hindu Arabic numerals. Show all steps.

a. MCDXCVI

Score: /2

b. 

Score: /2

c. 

Problem 7: Convert 2103_4 into a number in base 10.

Score: /2

Score: /2

Problem 8: Identify the base of each of the following. Show your steps for arithmetic operations.

a. A consecutive counting sequence: $\dots, 75, 76, 77, 100, 101, \dots$

b. A consecutive counting sequence : $\dots, 19, 1A, 1B, 1C, 20, 21, \dots$

c. An addition: $425 + 333 = 1061$. Give the base to make this addition correct.

d. A subtraction: $24A - 5D = 1ED$. Give the base to make this subtraction correct.

Problem 9: Write the place value for each place in 732.105 base 6.

Score: /6

Score: /3

Problem 10: Perform the following multiplication using the Russian peasant algorithm: 36×342 . Why does the algorithm work?

Score: /3

Problem 11: Use your understanding of arithmetic to complete each, given $4000 \div 16 = 250$.

a. $4,000,000 \div 16$

b. $2000 \div 8$

c. $4000 \div 0.8$

Score: /3

Problem 12: Name the property used to establish each equality.

a. $(13 \times 25) \times 4 \times 11 = 13 \times (25 \times 4) \times 11$.

b. $a \times (b + c) = ab + ac$

c. $X + 0 = 0 + X = X$

d. $424 \times 0 = 0$

Score: /2

Problem 13: Using the approach specified in each part to illustrate the following.

a. Use the Cartesian product approach for 3×2 . Include well-defined sets and appropriate set notation in your solution.

Score: /2

b. Use partitive model of division for $4 \div \frac{1}{3}$.

Score: /2