

Instructions: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each problem.

1. Let A be the set of letters in the name MATHEMATICAL and let B be set of letters in the name ENLIGHTENMENT. (5 points each)

a. List the elements in set A using proper set notation.

$$A = \{M, A, T, H, E, I, C, L\}$$

b. List the elements in set B using proper set notation.

$$B = \{E, N, L, I, G, H, T, M\}$$

c. Find $A \cap B$.

$$\{E, L, I, H, T, M\}$$

d. Find $A \cup B$.

$$\{M, A, T, H, E, I, C, L, N, G\}$$

e. What is the cardinality of set A, i.e. $n(A) = |A|$?

8

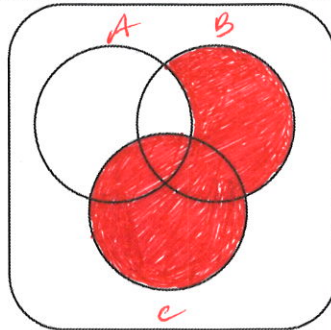
f. What is the cardinality of set $A \cap B$?

6

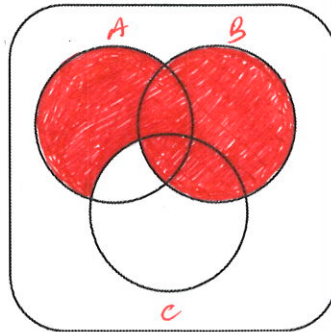
- g. What is the cardinality of $A \times B$? (Do not attempt to list all the elements, just say how big the set is.)

$$8 \times 8 = 64$$

2. Draw a Venn Diagram that illustrates each of the following sets (5 points each)



- a. $(A' \cap B) \cup C$



- b. $(A - C) \cup B$

3. At a southern university, half of the 48 mathematics majors were receiving federal financial aid: (20 points)

- 5 had Pell grants
- 14 participated in College Work Study programs
- 4 had TOPS scholarships
- 2 had TOPS scholarships and participated in Work Study.
- Those with Pell grants had no other financial aid.

- a. How many of the 48 math majors had no federal aid?

27

- b. How many had more than one of these three forms of aid?

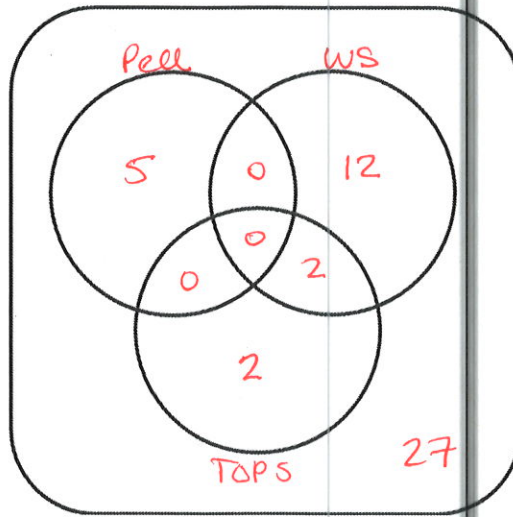
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c. How many had a TOPS scholarship or Work Study?

16

d. How many had exactly one of these three forms of aid?

19

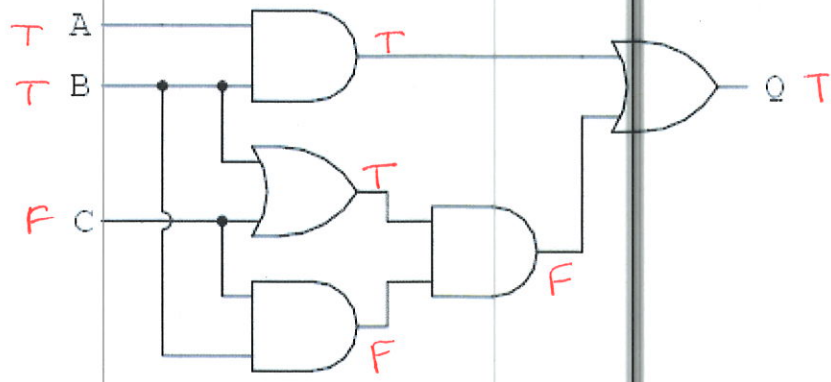


4. Construct truth tables for each of the following statements.

a. $(p \rightarrow \sim r) \vee q$ (10 points)

P	q	r	$\sim r$	$p \rightarrow \sim r$	$(p \rightarrow \sim r) \vee q$
T	T	T	F	F	T
T	T	F	T	T	T
T	F	T	F	F	F
T	F	F	T	T	T
F	T	T	F	T	T
F	T	F	T	T	T
F	F	T	F	T	T
F	F	F	T	T	T

5. Find the truth value of the logic gates below using the fact that A is True, B is True, and C is False. (8 points)



6. Write the following numerals in historical counting systems in the Hindu-Arabic system. (8 points each)

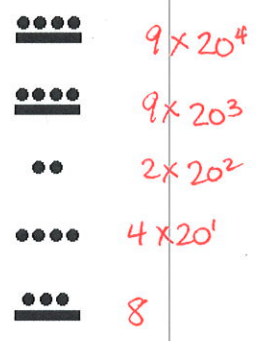


23,527

a.

b. $\overline{MCCLVII}DXCIV$

1,257,594



= 1,512,888

c.

7. Write the number 5,631 in the following numeral systems: (6 points each)

a. Babylonian



$5631 - 3600 = 2031$
 $2031 - 33 \times 60 = 51$

b. Chinese

五千六百三十一

8. Use the lattice method to calculate 581×74 . (6 points)

	5	8	1	
3	5	6	7	7
2	0	3	2	4
				4

42,994

9. Write the number 143 in the following bases: (6 points each)

a. Base-2 (binary)

10001111

$$143 - 128 = 15$$

$$15 - 8 = 7$$

b. Base-16 (Hexadecimal)

8F

$$143 / 16 = 8 +$$

$$143 - 8 \times 16 = 15$$

10. Convert the number 6713_8 in the given base into base-10. (6 points)

$$6 \times 8^3 + 7 \times 8^2 + 1 \times 8 + 3$$

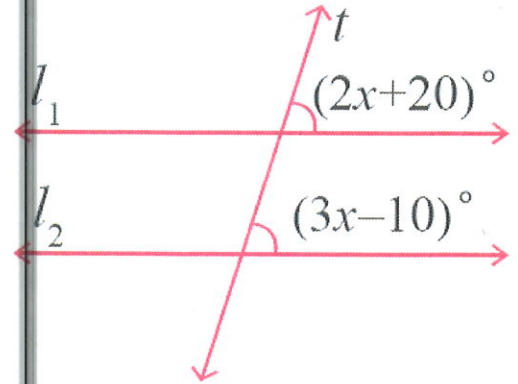
$$= 3531$$

11. Use the shortened Binet formula $F_N = \left\lfloor \left(\frac{1+\sqrt{5}}{2} \right)^N / \sqrt{5} \right\rfloor$ to find F_{12} . (8 points)

144

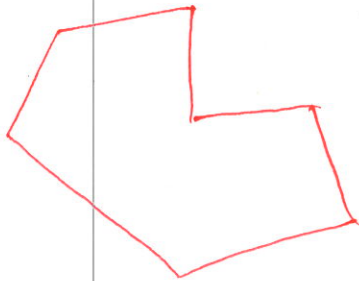
12. Find x if l_1 and l_2 are parallel. (10 points)

$$\begin{array}{r} 2x+20 = 3x-10 \\ -2x+10 \quad -2x+10 \\ \hline 30 = x \end{array}$$

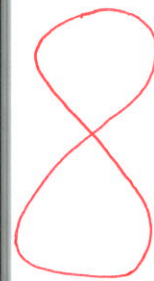


13. Give an example of a shape that is a polygon and one that is not. Explain why you classified each one the way you did. (10 points)

Simple closed



Polygon

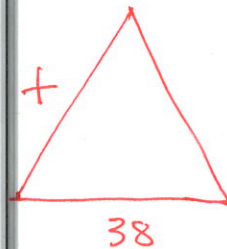
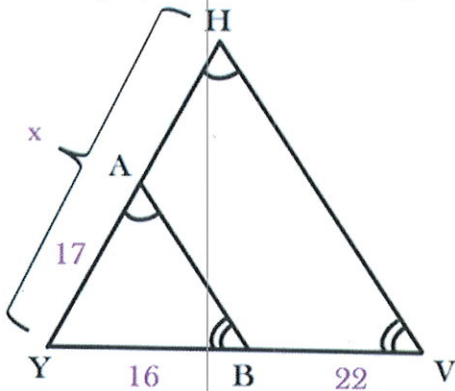


not straight lines
not simple

not a polygon

answers will vary

14. Use the properties of similar triangles to find the value of x . (12 points)



$$\frac{x}{17} = \frac{38}{16}$$

$$16x = 646$$

$$x = 40.375$$