

SETS HOMEWORK

TEXT: 1.1, 1.2

LAST NAME	FIRST NAME	DATE
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1. Use the roster notation to list the elements of the set of English letters in the word *Mississippi*.
2. Use the roster notation to list the days of the week whose names contain the letter *u*.
3. Use the roster notation to list months whose names end with the letter *y*.
4. Use a formal notation to describe the set of all people who traveled outside of the Solar system and came back to tell their story.
5. Use the roster notation to represent the set $V = \{v \mid v \text{ is an English vowel}\}$.
6. Use the roster notation to describe the set of English letters in this sentence.
7. Use the roster notation to describe the set of all countries whose names start with “Z”.

Consider the sets defined below:

$$U = \{a, b, c, \dots, x, y, z\} \quad (\text{the universe is the set of all English letters})$$

$$W = \{f, r, a, c, t, i, o, n\}$$

$$C = \{c, a, t\}$$

$$Y = \{a, y, e\}$$

Determine whether each statement is true or false:

8. $w \in W$

11. $\{c\} \in C$

14. $W \subseteq U$

9. $a \in Y$

12. $C \in U$

15. $Y \subseteq W$

10. $z \in W$

13. $C \subseteq W$

Define sets A , B , F , and M as follows:

$$A = \{0, 3, 6, 9\}$$

$$B = \{-1, -4, -7, -10\}$$

$$F = \{k \mid k \text{ is an integer multiple of } 5\}$$

$$M = \{n \mid n \text{ is a negative integer}\}$$

Determine whether the following statements are true or false:

16. $3 \in A$

21. $0 \in M$

26. $B \subseteq M$

17. $7 \in B$

22. $\{10, 15\} \subseteq F$

27. $F \subseteq F$

18. $0 \in F$

23. $\{-1, -2\} \in M$

19. $-25 \in F$

24. $\emptyset \in A$

20. $-7 \in M$

25. $\emptyset \subseteq A$

Rewrite each set using the roster notation.

28. $\{x \mid x \text{ is a prime number and } 9 \leq x \leq 19\}$

29. $\{x/2 \mid x \text{ is an even integer and } 7 < x < 17\}$

30. $\{5 - 6x^2 \mid x \text{ is an odd integer and } -3 < x < 3\}$

31. $\{4x - 7 \mid x \text{ is an integer and } -7 \leq x \leq -5\}$

32. $\{1 + 10^n \mid n \text{ is a positive integer and } n \leq 6\}$

33. $\left\{\frac{x}{x+2} \mid x \text{ is an integer and } 0 \leq x \leq 4\right\}$

Find an expression for the left side of the set-builder notation, so as to generate the given set.

34. Express the set $\{5, 10, 15, 20, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is a positive integer} \}$$

35. Express the set of the third powers of integers $\{0, 1, -1, 8, -8, 27, -27, 64, -64, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is an integer} \}$$

36. Express the set of integers less than or equal to -7 : $\{-7, -8, -9, -10, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is a positive integer} \}$$

37. Express the set of positive integers that end with seven: $\{7, 17, 27, 37, 47, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is a positive integer} \}$$

38. Express the set $\{4.1, 5.1, 6.1, 7.1, 8.1, 9.1, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is a positive integer} \}$$

39. Express the set $\{0, -3, -6, -9, -12, -15, \dots\}$ as

$$\{ \quad \quad \quad \mid m \text{ is a non-negative integer} \}$$

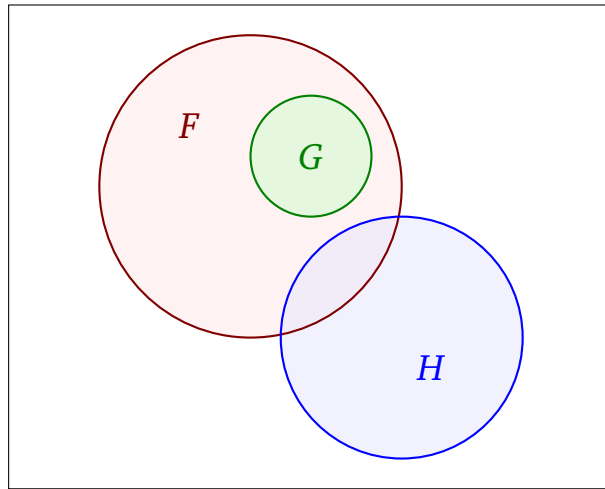
40. Express the set $\{0.1, 0.01, 0.001, 0.0001, 0.00001, 0.000001, \dots\}$ as

$$\{ \quad \quad \quad \mid k \text{ is a positive integer} \}$$

41. Express the set $\{0, 1, 2, 3, 4, 5, 6, \dots\}$ as

$$\{ \quad \quad \quad \mid x \text{ is an integer} \}$$

The following diagram shows 3 sets of points on the plane, contained within the rectangular universal set U .



Determine whether the following statements are true or false:

42. $G \subseteq F$

46. $G \subseteq U$

43. $G \subset F$

47. $G \subseteq G$

44. $H \subseteq F$

48. $G \subset G$

45. $H \subset F$

49. $\emptyset \subset G$

50. Draw a diagram similar to the one above with sets $A \subset B \subset C \subset D$.

Let the universe $U = \mathbb{R}$ be the set of all real numbers, and let

$$M = \{x \mid -10 < x < 10\}$$

$$L = \{x \mid x \leq 10\}$$

$$R = \{x \mid x > 1\}$$

$$P = \{x \mid x \text{ is prime}\}$$

Determine whether each statement is true or false:

51. $M \subset L$

54. $P \subset R$

52. $\{7\} \in M$

55. $\{2\} \subset P$

53. $\{6, 8, 10\} \subseteq L$

56. $R \subseteq M$

57 (†). Use the $\subset$ relation to order the given sets, listed here without any particular order:

$$W = \{x \mid x \text{ is a positive integer}\}$$

$\mathbb{R}$ The set of real numbers

$$M = \{3, 5, 7\}$$

$\emptyset$

$$D = \{x \mid x \text{ is a positive odd integer}\}$$

$$P^* = \{x \mid x \text{ is an odd prime number}\}$$

$\mathbb{Q}$ The set of rational numbers

$$N = \{x \mid x \text{ is a non-negative integer}\}$$

$\mathbb{Z}$ The set of integers

(†) A set X is called *transitive* when for every $A \in X$, it is also true that $A \subseteq X$. For each of the following sets, determine whether it is transitive. If a set is not transitive, prove it by stating a set A which provides a counterexample to the definition, that is: $A \in X$, but $A \not\subseteq X$.

58. $\emptyset$

59. $\{\emptyset\}$

60. $\{\{\emptyset\}\}$

61. $\{\emptyset, \{\emptyset\}\}$

62. $\{\emptyset, \{\emptyset\}, \{\{\emptyset\}\}\}$

63. The set $B = \{B\}$

64. The set $C = \{C, D\}$, where $D = \{E\}$ and $E = \{D\}$, with $E \neq D$.

ANSWERS

1. $\{M, i, s, p\}$
3. $\{\text{January, February, May, July}\}$
5. $\{a, e, i, o, u\}$, though sometimes y is also included.
7. $\{\text{Zambia, Zimbabwe}\}$
9. true
11. false
13. true
15. false
17. false
19. true
21. false
23. false
25. true
27. true
29. $\{4, 5, 6, 7, 8\}$
31. $\{-35, -31, -27\}$
33. $\left\{0, \frac{1}{3}, \frac{1}{2}, \frac{3}{5}, \frac{2}{3}\right\}$
35. $\{x^3 \mid x \text{ is an integer}\}$
37. $\{10(x-1) + 7 \mid x \text{ is a positive integer}\}$
39. $\{-3m \mid m \text{ is a non-negative integer}\}$
41. $\{|x| \mid x \in \mathbb{Z}\}$
43. true

45. false

47. true

49. true

51. true

53. true

55. true