MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use set notation to list all the elements of the set.

1) The integers between 4 and 8, not inclusive
A) {4, 5, 6, 7} B) {5, 6, 7} C) {4, 5, 6, 7, 8} D) {5, 6, 7, 8}
Answer: B

2) The integers from 3 to 7 inclusive
A) {3, 4, 5, 6} B) {4, 5, 6} C) {3, 4, 5, 6, 7} D) {4, 5, 6, 7}
Answer: C

3) The whole numbers greater than 3 and less than 7
A) {4, 5, 6} B) {4, 5, 6, 7} C) {3, 4, 5, 6} D) {3, 4, 5, 6, 7}
Answer: A

4) The letters needed to spell these words:
tear, rate, rat, tea
A) {t,t,a,a,r,r,e} B) {r,a,t}
C) {t,t,t,t,r,r,r,a,a,a,a,e,e,e} D) {a,e,r,t}
Answer: D

5) {x : x is an integer between 14 and 17 inclusive}
A) {14, 15, 16, 17} B) {15} or {16}
C) {13, 14, 15, 16, 17, 18} D) {15, 16}
Answer: A

6) {x : x is an integer between 15 and 18 not inclusive}
A) {16} or {17} B) {16, 17}
C) {14, 15, 16, 17, 18, 19} D) {15, 16, 17, 18}
Answer: B

7) {x : x is an even natural number less than 10}
A) {2, 4, 6, 8} B) {1, 2, 3, 4, 5, 6, 7, 8, 9}
C) {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} D) {0, 2, 4, 6, 8}
Answer: A

8) The natural numbers between –3 and 1, not inclusive
A) {0, 1} B) {0} C) {–2, –1, 0} D) ∅
Answer: D

9) The whole numbers between –3 and 0, not inclusive
A) {0} B) {–2, –1} C) ∅ D) {–3, –2, –1, 0}
Answer: C

Use an alternative method to express the set.

10) {x: x has bike trails}

The table shows some of the facilities available at selected State Parks in New Jersey.

	camping	hiking trails	boating	swimming	bike trails	visitor center
Allaire	yes	yes	no	yes	no	yes
Parvin	yes	yes	yes	yes	no	yes
Delaware and Raritan Canal	no	yes	yes	yes	yes	no
Corson's Inlet	no	yes	yes	no	no	no
Wharton Forest	yes	yes	yes	yes	no	yes

A) {Allaire, Parvin, Corson's Inlet, Wharton Forest} B) (Delaware and Raritan Canal)

C) ∅ D) {Delaware and Raritan Canal}

Answer: D

11) {t, a, b, l, e}

A) {z : z is a letter in the word table} B) {table}

C) {z : z is a table} D) (z is a letter in table)

Answer: A

12) {d : d is a letter in the word cat and also in the word in}

A) (c, a, t, i, n) B) { } C) {c, a, t, i, n} D) {∅}

Answer: B

13) {21, 28, 35, ..., 105}

A) {x : x is a multiple of 7 greater than 21 and less than 105}

B) {b : b is a multiple of 7 greater than or equal to 21}

C) {t : t is a multiple of 7 greater than 20 and less than 106}

D) {w : w is a multiple of 7}

Answer: C

Determine whether the set is well defined or not.

14) {x : x is a tennis player who has won at Wimbledon}

A) Not well defined B) Well defined

Answer: B

15) {x : x is a low–fat ice cream}

A) Not well defined B) Well defined

Answer: A

16) {x :x is a football team that has won the Super Bowl}

A) Not well defined B) Well defined

Answer: B

17) {x : x is horror books in the library}

A) Not well defined B) Well defined

Answer: A

18) {x : x is stock on the AmEx today}

A) Not well defined B) Well defined

Answer: B

19) {x : x is an expensive boat on the Great Lakes}
A) Not well defined B) Well defined
Answer: A

20) {x : x is a four–year college in Georgia}
A) Not well defined B) Well defined
Answer: B

Replace the # with either ∈ or ∉ to express a true statement.

21) 88 # {8, 16, 24, 32, ... }
A) ∈ B) ∉
Answer: A

22) –4.5 # {n : n is a whole number}
A) ∉ B) ∈
Answer: A

23) Iowa # {r : r is a state in the United States}
A) ∈ B) ∉
Answer: A

24) Ohio # {California, Vermont, Colorado, New Jersey, Washington, Kentucky}
A) ∉ B) ∈
Answer: A

Find n(A) for the set.

25) A = {0, 2, 4, 6, 8}
A) n(A) = 5 B) n(A) = 8 C) n(A) = 2 D) n(A) = 4
Answer: A

26) A = {x : x is a month in the year}
A) n(A) = 52 B) n(A) = 1 C) n(A) = 12 D) n(A) = 24
Answer: C

27) A = {x : x is a second in a minute}
A) n(A) = 60 B) n(A) = 12 C) n(A) = 120 D) n(A) = Infinite
Answer: A

28) A = {–9, –8, –7, . . ., 0}
A) n(A) = 10 B) n(A) = 9 C) n(A) = 4 D) n(A) = 1
Answer: A

29) A = {{a, b}, {c, d}, {e, b}}
A) n(A) = 5 B) n(A) = 2 C) n(A) = 3 D) n(A) = 6
Answer: C

30) A = {∅, 0}
A) n(A) = ∅ B) n(A) = 1 C) n(A) = 0 D) n(A) = 2
Answer: D

31) A = {{∅}, {0}, {∅, 0}}
A) n(A) = 2 B) n(A) = 4 C) n(A) = 0 D) n(A) = 3
Answer: D

32) A = {x : x is a vowel in the word infinite}
A) n(A) = 3 B) n(A) = 2 C) n(A) = 5 D) n(A) = 4
Answer: B

Identify the set as finite or infinite.

33) {4, 5, 6, . . ., 16}
A) Finite B) Infinite
Answer: A

34) {1, 1/3, 1/9, 1/27, . . .}
A) Infinite B) Finite
Answer: A

35) {x : x is a fraction between 5 and 6}
A) Infinite B) Finite
Answer: A

36) {2, 4, 6, 8, ...}
A) Infinite B) Finite
Answer: A

37) The set of even whole numbers less than 50
A) Infinite B) Finite
Answer: B

38) The set of even numbers greater than 100
A) Finite B) Infinite
Answer: B

39) The set of multiples of 3 between 0 and 100
A) Infinite B) Finite
Answer: B

40) The set of fractions that are less than 1 but greater than 0
A) Infinite B) Finite
Answer: A

41) The set of people watching fireworks at Miller Park on July 4, 2000 at 9:45 P.M.
A) Finite B) Infinite
Answer: A

42) The set of stars in the Milky Way Galaxy at 12:00 A.M. on January 1, 2000
A) Finite B) Infinite
Answer: A

Decide whether the sets are equal.

43) {b: b is a positive integer} and {k : k is a counting number}
A) Yes B) No
Answer: A

44) {y : y was an American President in the year 1573} and ∅
A) No B) Yes
Answer: B

45) {parsley, thyme, saffron, oregano} and {y : y is an herb}
A) Yes B) No
Answer: B

46) {6, 12, 18, 24, 48} and {6, 12, 18, 24, ..., 48}
A) No B) Yes
Answer: A

Decide whether the statement is true or false.

47) {12, 20, 32, 52} ⊆ {2, 4, 6, 8, ..., 98}
A) False B) True
Answer: B

48) {12, 84, 145, 264} ⊆ {12, 24, 36, ..., 1080}
A) True B) False
Answer: B

49) {a : a is an odd integer} ⊂ {b : b is a positive integer}
A) True B) False
Answer: B

50) ∅ ⊆ {4, 8, 12, 16, 20}
A) False B) True
Answer: B

Decide whether the sets are equivalent.

51) {x : x is a multiple of 10 between 1 and 100, inclusive} and {9, 18, 27, ..., 90}
A) Yes B) No
Answer: A

52) {d: d is a month of the year} and {g : g is a state in the United States}
A) Yes B) No
Answer: B

53) {64, 26, 87, 9, 68} and {z, m, c, u, y}
A) Yes B) No
Answer: A

54) {∅} and {x : x is a state in the U.S. with a minimum voting age of 64}
A) No B) Yes
Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

List the subsets.

55) List all of the two element subsets of the set {a, b, c, d}.

Answer: {a, b}, {a, c}, {a, d}, {b, c}, {b, d}, {c, d}

56) List all of the two element subsets of the set {a, b, c, d, e}.

Answer: {a, b}, {a, c}, {a, d}, {a, e}, {b, c}, {b, d}, {b, e}, {c, d}, {c, e}, {d, e}

57) List all of the three element subsets of the set {a, b, c, d}.

Answer: {a, b, c}, {a, b, d}, {a, c, d}, {b, c, d}

58) List all of the three element subsets of the set {a, b, c, d, e}.

Answer: {a, b, c}, {a, b, d}, {a, b, e}, {a, c, d}, {a, c, e}, {a, d, e}, {b, c, d}, {b, c, e}, {b, d, e}, {c, d, e}

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the following definitions to determine if the statement is true or false.
N = {x : x is a natural number}
I = {x : x is an integer}
R = {x : x is a real number}
W = {x : x is a whole number}
Q = {x : x is a rational number}

59) W is a subset of W, I, Q, and R.

A) True B) False

Answer: A

60) W is a subset of N, W, I, Q, and R.

A) True B) False

Answer: B

61) I is a subset of Q.

A) True B) False

Answer: A

62) N is a subset of N.

A) True B) False

Answer: A

63) W is a proper subset of I, Q, and R.

A) True B) False

Answer: A

64) W is a proper subset of I, Q, N, and R.

A) True B) False

Answer: B

65) I is a proper subset of Q and R.

A) True B) False

Answer: A

66) I is a proper subset of N, W, Q, and R.
A) True B) False
Answer: B

67) Q is a proper subset of R.
A) True B) False
Answer: A

68) Q is a proper subset of N, I, and W.
A) True B) False
Answer: B

Find the number of subsets of the set.

69) {14, 15, 16}
A) 6 B) 7 C) 3 D) 8
Answer: D

70) {0}
A) 2 B) 0 C) 1 D) 4
Answer: A

71) {mom, dad, son, daughter}
A) 16 B) 14 C) 8 D) 12
Answer: A

72) {math, English, history, science, art}
A) 24 B) 32 C) 28 D) 16
Answer: B

73) {x | x is a day of the week}
A) 124 B) 128 C) 127 D) 256
Answer: B

74) {x | x is an even number between 17 and 37}
A) 1024 B) 7 C) 36 D) 128
Answer: A

75) {1, 2, 3, . . . , 8}
A) 512 B) 256 C) 16 D) 252
Answer: B

Let U = {q, r, s, t, u, v, w, x, y, z}
A = {q, s, u, w, y}
B = {q, s, y, z}
C = {v, w, x, y, z}. List the elements in the set.

76) $A \cap B'$
A) {r, s, t, u, v, w, x, z} B) {u, w}
C) {q, s, t, u, v, w, x, y} D) {t, v, x}
Answer: B

77) $(A \cup B)'$

A) {t, v, x} B) {r, s, t, u, v, w, x, z} C) {s, u, w} D) {r, t, v, x}

Answer: D

78) $(A \cap B)'$

A) {s, u, w} B) {t, v, x}

C) {q, s, t, u, v, w, x, y} D) {r, t, u, v, w, x, z}

Answer: D

79) $A' \cup B$

A) {q, r, s, t, v, x, y, z} B) {q, s, t, u, v, w, x, y}

C) {r, s, t, u, v, w, x, z} D) {s, u, w}

Answer: A

80) $A \cup (B \cap C)$

A) {q, r, w, y, z} B) {q, w, y} C) {q, y, z} D) {q, s, u, w, y, z}

Answer: D

81) $A \cap (B \cup C)$

A) {q, s, w, y} B) {q, y, z} C) {q, s, u, w, y, z} D) {q, r, w, y, z}

Answer: A

82) $C' \cup A'$

A) {w, y} B) {s, t}

C) {q, r, s, t, u, v, x, z} D) {q, s, u, v, w, x, y, z}

Answer: C

83) $C' \cap A'$

A) {q, r, s, t, u, v, x, z} B) {w, y}

C) {q, s, u, v, w, x, y, z} D) {r, t}

Answer: D

84) $C - A$

A) {q, s, u} B) {q, s, u, v, x, z} C) {v, x, z} D) {w, y}

Answer: C

85) $A - C$

A) {q, s, u, v, x, z} B) {w, y} C) {q, s, u} D) {v, x, z}

Answer: C

Let U = {all soda pops}; A = {all diet soda pops}; B = {all cola soda pops}; C = {all soda pops in cans}; and D = {all caffeine–free soda pops}. Describe the given set in words.

86) $A \cap B$

A) All soda pops B) All diet and all cola soda pops

C) All diet–cola soda pops D) All diet or all cola soda pops

Answer: C

87) $A' \cap C$

A) All non–diet soda pops and all soda pops in cans
B) All diet soda pops and all soda pops in cans
C) All non–diet soda pops in cans
D) All diet soda pops in cans

Answer: C

88) $A \cap B \cap D$

A) All diet, all cola, and all caffeine–free soda pops
B) All soda pops not in cans
C) All diet, caffeine–free, cola soda pops in cans
D) All diet, caffeine–free, cola soda pops

Answer: D

89) $(A \cup B) \cup D$

A) All diet, all cola, and all caffeine–free soda pops
B) All soda pops not in cans
C) All soda pops
D) All diet, caffeine–free, cola soda pops

Answer: A

90) $(A \cap B) \cap C'$

A) All non–diet, non–cola soda pops not in cans
B) All cola soda pops not in cans
C) All diet and all cola soda pops not in cans
D) All diet–cola soda pops not in cans

Answer: D

91) $(A \cup D) \cap C'$

A) All non–cola soda pops not in cans
B) All diet, caffeine–free soda pops not in cans
C) All soda pops not in cans that are diet or caffeine–free
D) All non–diet, non–caffeine–free soda pops not in cans

Answer: C

Describe the indicated set in words and find the set.

92) $(P \cap C)$, given the following information:

The table gives features of different dishwashers.

model	price (dollars)	clean china	clean glassware	energy efficiency	noise level
a	732	excellent	good	good	low
b	469	excellent	good	fair	moderate
c	568	excellent	good	good	high
d	620	excellent	good	good	high
e	570	good	fair	good	low
f	354	excellent	fair	good	moderate
g	494	good	fair	fair	moderate
h	330	good	fair	fair	moderate
i	232	fair	poor	good	moderate

In the universal set U = {a, b, c, ..., i}, let the following characteristics be defined:

P = price is at or below $469

C = does an excellent job of cleaning china

G = does an excellent job of cleaning glassware

E = has a good energy efficiency rating

F = has low noise level

A) Dishwashers costing $469 or less that do an excellent job of cleaning china; {a, b, f}

B) Dishwashers costing $469 or less that do an excellent job of cleaning china; {b, f}

C) Dishwashers that do an excellent job of cleaning china; {a, b, c, d, f}

D) Dishwashers costing $469 or less and dishwashers that do an excellent job of cleaning china; {a, b, c, d, f}

Answer: B

93) $P - (E \cup C)'$, given the following information:

The table gives features of different dishwashers

model	price (dollars)	clean china	clean glassware	energy efficiency	water usage
a	712	excellent	good	good	low
b	455	excellent	good	fair	moderate
c	554	excellent	good	good	high
d	606	excellent	good	good	high
e	556	good	fair	good	low
f	385	excellent	fair	good	moderate
g	480	good	fair	fair	moderate
h	361	good	fair	fair	moderate
i	263	fair	poor	good	moderate

In the universal set U = {a, b, c, ..., i}, let the following characteristics be defined:

P = price is at or below $455

C = does an excellent job of cleaning china

G = does an excellent job of cleaning glassware

E = has a good energy efficiency rating

F = has low water usage

A) Dishwashers that cost $455 or less and either have a good energy efficiency rating or do an excellent job of cleaning china; {h}

B) Dishwashers that cost $455 or less and have either a low energy efficiency rating or do an excellent job of cleaning china; {a, b, c, d, e, f, h, i}

C) Dishwashers that cost $455 or less and either have a good energy efficiency rating or do an excellent job of cleaning china; {b, f, i}

D) Dishwashers that cost $455 or less and have both a low energy efficiency rating and do an excellent job of cleaning china; {f}

Answer: C

94) $(P \cap L) - S'$, given the following information:

The table gives the approximate nutritional value per serving of foods at a certain restaurant.

food	calories	protein (grams)	fat (grams)	calcium (mg)	sodium (mg)	vitamin A (A.U.)
Chop Suey	240	23	16	75	1250	1100
Pizza (cheese)	120	15	9	220	691	2720
Bean Burrito	340	20	4	185	1230	80
Spaghetti & Meatballs	330	19	13	124	1009	1590
Pea Soup	250	7	7	158	900	850
Chicken Salad	210	33	8	28	360	100
Milkshake	270	3	13	145	98	420

Let:

C = {m : m provides 251 or more calories}

P = {m : m provides 20 or more grams of protein}

F = {m : m provides 10 or more grams of fat}

L = {m : m provides 150 or more mg of calcium}

S = {m : m provides 1000 or more mg of sodium}

A = {m : m provides 1000 or more A.U. of vitamin A}

A) Foods that provide either 20 or more grams of protein or 150 or more mg of calcium, but have less than 1000 mg of sodium; {Pizza, Pea Soup, Chicken Salad}

B) Foods that provide both 20 or more grams of protein and 150 or more mg of calcium, but have less than 1000 mg of sodium; ∅

C) Foods that provide both 20 or more grams of protein and 150 or more mg of calcium, and have 1000 or more mg of sodium; {Chop Suey, Bean Burrito}

D) Foods that provide either 20 or more grams of protein or 150 or more mg of calcium, and have 1000 or more mg of sodium; {Chop Suey, Bean Burrito}

Answer: B

95) $(P \cup L) - (S \cap C)$, given the following information:

The table gives the approximate nutritional value per serving of foods at a certain restaurant.

food	calories	protein (grams)	fat (grams)	calcium (mg)	sodium (mg)	vitamin A (A.U.)
Chow Mein	240	23	16	75	1250	1100
Pizza (cheese)	120	15	9	220	705	2720
Bean Burrito	340	20	4	185	1230	80
Linguini & Meatballs	330	19	13	124	1009	1590
Pea Soup	250	7	7	158	900	850
Chicken Salad	210	33	8	28	360	100
Ice Cream	270	3	13	145	98	420

Let:

C = {m : m provides 251 or more calories}

P = {m : m provides 20 or more grams of protein}

F = {m : m provides 10 or more grams of fat}

L = {m : m provides 150 or more mg of calcium}

S = {m : m provides 1000 or more mg of sodium}

A = {m : m provides 1000 or more A.U. of Vitamin A}

A) Foods that have either 20 or more grams of protein or 150 or more mg of calcium, and also have either 1000 or more mg of sodium or 251 or more calories; {Chow Mein, Pizza, Bean Burrito, Pea Soup, Chicken Salad}

B) Foods that have either 20 or more grams of protein or 150 or more mg of calcium, but do not have both 1000 or more mg of sodium and 251 or more calories; {Chow Mein, Pizza, Pea Soup, Chicken Salad}

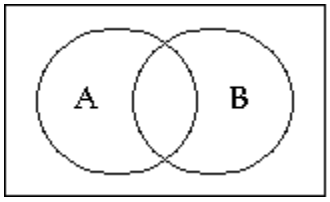
C) Foods that have both 20 or more grams of protein and 150 or more mg of calcium, but do not have both 1000 or more mg of sodium and 251 or more calories; ∅

D) Foods that have either 20 or more grams of protein or 150 or more mg of calcium, but do not have either 1000 or more mg of sodium or 251 or more calories; {Chow Mein, Pizza, Pea Soup, Chicken Salad}

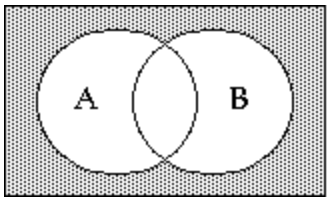
Answer: B

Shade the Venn diagram to represent the set.

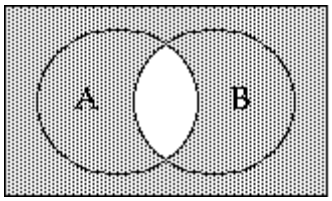
96) $A' \cap B'$



A)

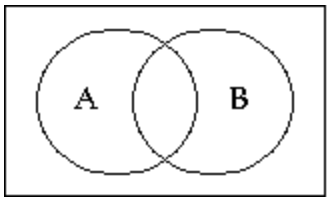


B)

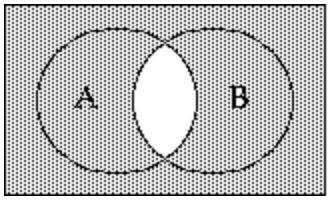


Answer: A

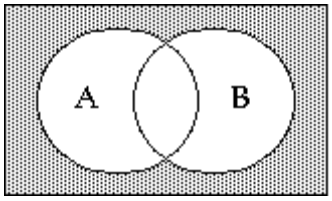
97) A' ∪ B'



A)

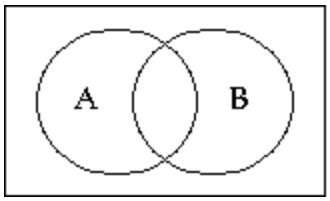


B)

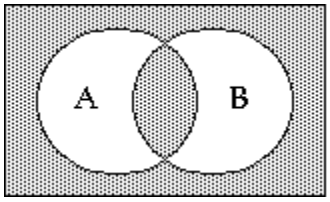


Answer: A

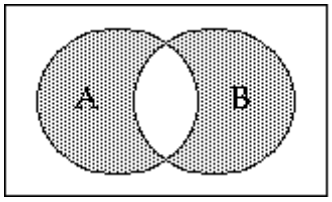
98) (A ∪ B) ∩ (A ∩ B)'



A)

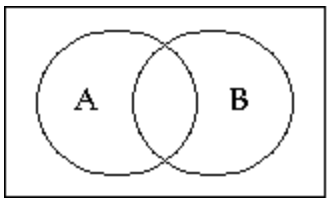


B)

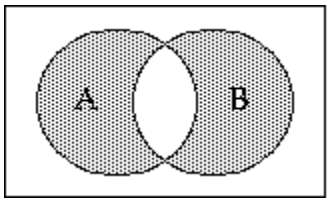


Answer: B

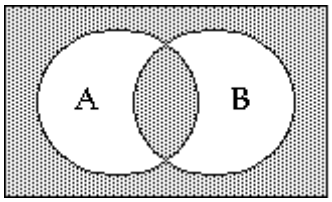
99) (A ∩ B) ∪ (A ∪ B)'



A)

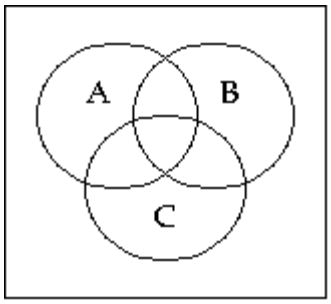


B)

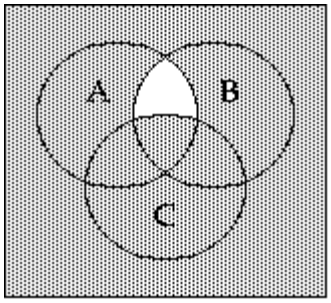


Answer: B

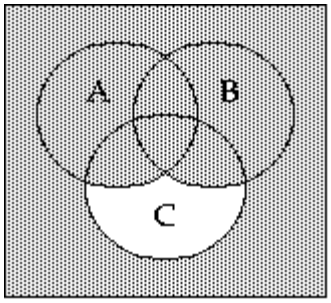
100) $(A \cap B \cap C')'$



A)

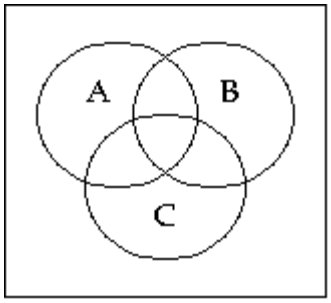


B)

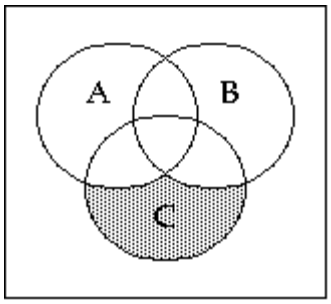


Answer: A

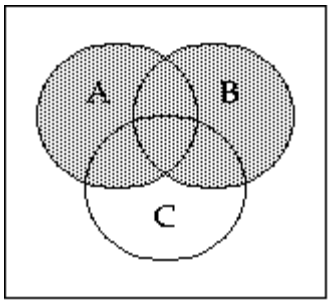
101) $(A \cup B \cup C')'$



A)

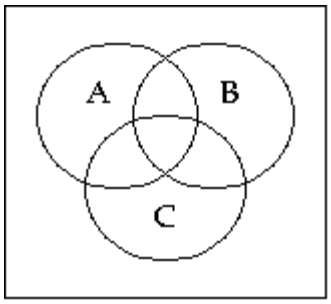


B)

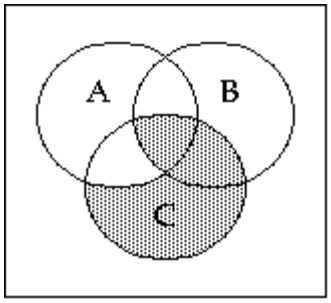


Answer: A

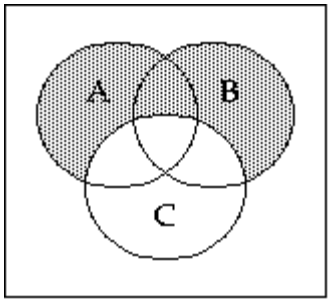
102) C' ∩ (A ∪ B)



A)

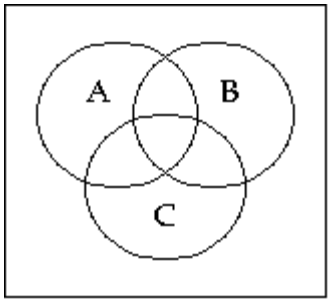


B)

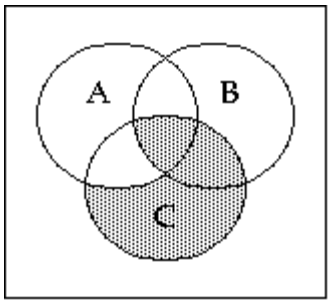


Answer: B

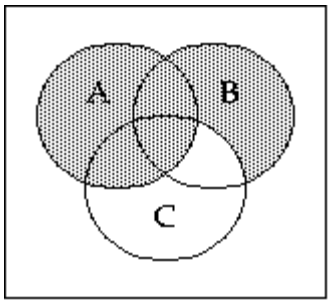
103) (A' ∪ B) ∩ C



A)

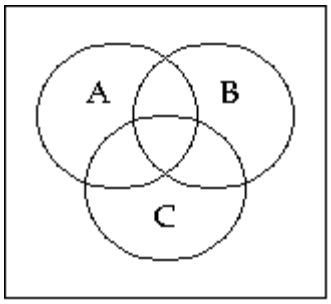


B)

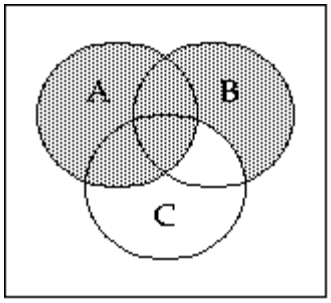


Answer: A

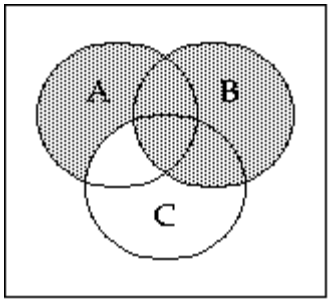
104) A ∪ (B ∩ C')



A)

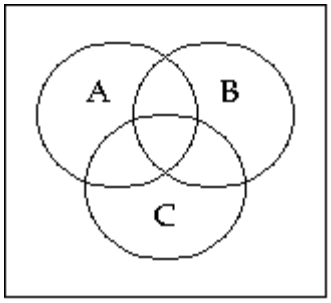


B)

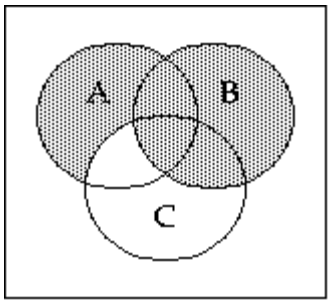


Answer: A

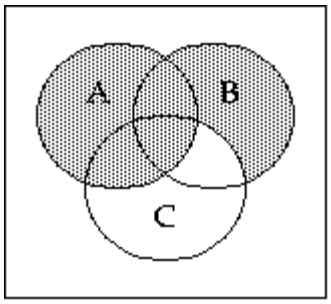
105) B ∪ (A ∩ C')



A)



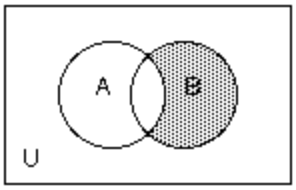
B)



Answer: A

Write a description of the shaded region using the symbols A, B, C, ∪, ∩, –, and ′ as needed.

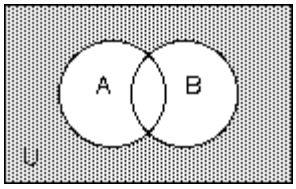
106)



A) B ∩ A′ B) A – B C) B – A′ D) A ∩ B′

Answer: A

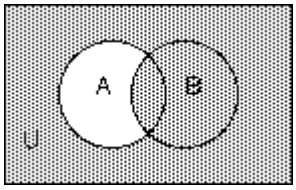
107)



A) A ∪ B B) A′ ∩ B′ C) A – B D) (A ∩ B)′

Answer: B

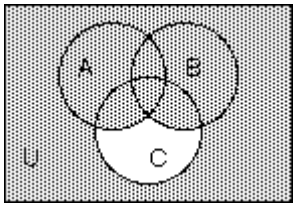
108)



A) A′ ∪ B B) (A ∩ B)′ C) A′ ∩ B D) B – A

Answer: A

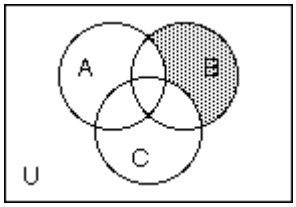
109)



A) (A ∪ B) ∪ C′ B) A ∪ B ∩ C′ C) (A ∩ B) ∪ C′ D) (A ∪ B ∪ C)′

Answer: A

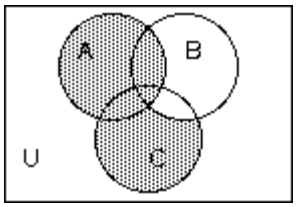
110)



A) B ∩ (A ∩ C)′ B) B – (A ∩ C) C) B′ – (A ∪ B) D) A′ ∩ C′ ∩ B

Answer: D

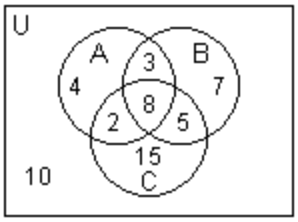
111)



A) A ∪ C – B B) B′ ∩ A ∪ C C) A ∪ C D) C ∩ B′ ∪ A

Answer: D

Use the Venn diagram below to find the number of elements in the region.



112) n(A)

A) 4 B) 17 C) 9 D) 12

Answer: B

113) n(A ∪ B)

A) 21 B) 14 C) 29 D) 11

Answer: C

114) n(C′)

A) 39 B) 29 C) 24 D) 14

Answer: C

115) n(C – A)

A) 13 B) 11 C) 20 D) 15

Answer: C

116) n(A ∩ C)

A) 18 B) 2 C) 37 D) 10

Answer: D

117) n(A ∩ B ∩ C)

A) 18 B) 44 C) 8 D) 16

Answer: C

118) n((A ∪ B) ∩ C)

A) 11 B) 33 C) 14 D) 15

Answer: D

119) n((C ∪ B) – (A ∪ B))

A) 2 B) 11 C) 15 D) 5

Answer: C

Let A and B be sets with cardinal numbers, n(A) = a and n(B) = b, respectively. Decide whether the statement is true or false.

120) $B \subset (B \cap A)$

A) True B) False

Answer: B

121) $(B \cup A) \subset B$

A) True B) False

Answer: B

122) $n(A \cup B) = n(A) - n(B)$

A) True B) False

Answer: B

123) $n(A - B) = n(B - A)$

A) True B) False

Answer: B

124) If $B \subseteq A$, $n(B) = n(A - B)$.

A) True B) False

Answer: B

125) If $B \subseteq A$, $n(B) = n(A) - n(A - B)$.

A) True B) False

Answer: A

126) $n(A \cap B) = n(B \cap A)$

A) True B) False

Answer: A

127) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

A) True B) False

Answer: A

128) $n(A \cap B) = n(A) - n(B)$

A) True B) False

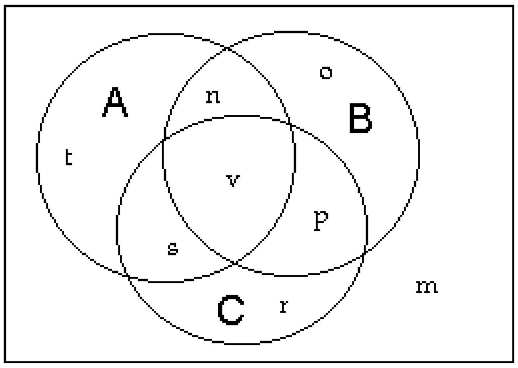
Answer: B

129) $n(A \cup B) + n(A \cap B) = n(A) + n(B)$

A) True B) False

Answer: A

Determine which labeled sections make up the indicated set.



130) $B \cap C$

A) p B) v, p C) s, v, p D) n, o, p, r, v, s

Answer: B

131) $A - B$

A) n, v B) t, s, v C) t D) t, s

Answer: D

132) $C - (A \cap B)$

A) r B) s, v, p C) p, r, s D) r, p

Answer: C

133) $C \cap A \cap B$

A) o B) n, v, s, p C) t, s, v, n, o, p, r D) v

Answer: D

Find, if possible, the number of elements in sets A, B, and C using the given information.

134) $n(A \cup B \cup C) = 21$
$n(A \cap B) = 4$
$n(A \cap C) = 5$
$n(A - B) = 6$
$n(C \cap B) = 8$
$n(A \cap B \cap C) = 2$
$n(C - (A \cup B)) = 2$

A) $n(A) = 8, n(B) = 15, n(C) = 13$ B) $n(A) = 8, n(B) = 11, n(C) = 15$
C) $n(A) = 10, n(B) = 13, n(C) = 13$ D) The information is inconsistent or incomplete.

Answer: C

135) $n(A - C) = 10$
$n(C - A) = 2$
$n(A \cup C) = 22$
$n(A \cap B) = 10$
$n((C \cap A) - B) = 4$
$n((A \cap B) - C) = 4$
$n(B - (A \cup C)) = 3$
$n(B \cap C) = 7$

A) $n(A) = 16, n(B) = 18, n(C) = 12$ B) $n(A) = 12, n(B) = 25, n(C) = 20$
C) $n(A) = 20, n(B) = 14, n(C) = 12$ D) The information is inconsistent or incomplete.

Answer: C

136) $n(A - C) = 10$
$n(C - A) = 3$
$n(A \cap B) = 8$
$n(C \cap A) = 8$
$n(C \cap B) = 6$
$n(B - A) = 8$
$n(A \cap B \cap C) = 4$

A) $n(A) = 18, n(B) = 16, n(C) = 11$ B) $n(A) = 22, n(B) = 20, n(C) = 15$
C) $n(A) = 11, n(B) = 27, n(C) = 18$ D) The information is inconsistent or incomplete.

Answer: A

137) $(A \cap B) = \varnothing$
$n(A \cap C) = 8$
$n(C - B) = 14$
$n(B - C) = 6$
$n(A - C) = 5$
$n(B \cup C) = 25$

A) $n(A) = 5, n(B) = 19, n(C) = 27$ B) $n(A) = 13, n(B) = 11, n(C) = 24$
C) $n(A) = 13, n(B) = 11, n(C) = 19$ D) The information is inconsistent or incomplete.

Answer: C

Solve the problem.

138) A local television station sends out questionnaires to determine if viewers would rather see a documentary, an interview show, or reruns of a game show. There were 450 responses with the following results:

135 were interested in an interview show and a documentary, but not reruns.
18 were interested in an interview show and reruns but not a documentary.
63 were interested in reruns but not an interview show.
108 were interested in an interview show but not a documentary.
45 were interested in a documentary and reruns.
27 were interested in an interview show and reruns.
36 were interested in none of the three.

How many are interested in exactly one kind of show?

A) 216 B) 206 C) 226 D) 196

Answer: A

139) A survey of 240 families showed that
91 had a dog;
70 had a cat;
31 had a dog and a cat;
91 had neither a cat nor a dog nor a parakeet;
7 had a cat, a dog, and a parakeet.

How many had a parakeet only?

A) 24 B) 34 C) 29 D) 19

Answer: D

140) A survey of a group of 117 tourists was taken in St. Louis. The survey showed the following:
66 of the tourists plan to visit Gateway Arch;
47 plan to visit the zoo;
10 plan to visit the Art Museum and the zoo, but not the Gateway Arch;
14 plan to visit the Art Museum and the Gateway Arch, but not the zoo;
19 plan to visit the Gateway Arch and the zoo, but not the Art Museum;
7 plan to visit the Art Museum, the zoo, and the Gateway Arch;
16 plan to visit none of the three places.

How many plan to visit the Art Museum only?
A) 36 B) 101 C) 47 D) 14

Answer: D

141) A survey of 128 college students was done to find out what elective courses they were taking. Let A = the set of those taking art, B = the set of those taking basketweaving, and C = the set of those taking canoeing. The study revealed the following information.
$n(A) = 45$ $n(A \cap B) = 12$
$n(B) = 55$ $n(A \cap C) = 15$
$n(C) = 40$ $n(B \cap C) = 23$
$n(A \cap B \cap C) = 2$

How many students were not taking any of these electives?
A) 46 B) 38 C) 10 D) 36

Answer: D

Find the cardinal number of the indicated set by referring to the given table.

142) $H \cup A$,
given the following table:

U.S. Production (in Thousands of Tons) of Certain Nuts				
Year	Pecans (P)	Almonds (A)	Walnuts (W)	Hazelnuts (H)
1993 (T)	181	584	232	41
1994 (F)	99	585	232	21
1995 (V)	134	304	229	39
1996 (S)	111	412	205	17

A) 543 B) 1038 C) 2003 D) 625

Answer: C

143) $V \cap W$,
given the following table:

U.S. Production (in Thousands of Tons) of Certain Nuts				
Year	Pecans (P)	Almonds (A)	Walnuts (W)	Hazelnuts (H)
1993 (T)	181	584	232	41
1994 (F)	99	587	232	21
1995 (V)	134	304	234	39
1996 (S)	111	412	205	21

A) 711 B) 368 C) 234 D) 0

Answer: C

144) A – (F ∪ S),
given the following table:

U.S. Production (in Thousands of Tons) of Certain Nuts				
Year	Pecans (P)	Almonds (A)	Walnuts (W)	Hazelnuts (H)
1993 (T)	184	584	232	41
1994 (F)	99	587	232	21
1995 (V)	134	304	230	39
1996 (S)	111	412	205	22

A) 759 B) 888 C) 175 D) 999

Answer: B

145) V ∩ (P ∪ W),
given the following table:

U.S. Production (in Thousands of Tons) of Certain Nuts				
Year	Pecans (P)	Almonds (A)	Walnuts (W)	Hazelnuts (H)
1993 (T)	183	584	232	41
1994 (F)	99	586	232	21
1995 (V)	134	304	235	39
1996 (S)	111	412	205	22

A) 158 B) 369 C) 343 D) 0

Answer: B

Show that the set has cardinal number $\aleph_0$ by establishing a one–to–one correspondence between the natural numbers and the given set. Be sure to indicate the general correspondence.

146) {3, 6, 9, 12, ...}

A) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
3, 6, 9, 12, ..., 3n, ...

B) 0, 1, 2, 3, ..., n, ...
↕ ↕ ↕ ↕ ↕
3, 6, 9, 12, ..., 3n, ...

C) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
3, 6, 9, 12, ..., n, ...

D) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
3, 6, 9, 12, ..., 4n, ...

Answer: A

147) {0, 3, 6, 9, 12, ...}

A) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
0, 3, 6, 9, ..., 3n – 3, ...

B) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
0, 3, 6, 9, ..., 3n – 1, ...

C) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
0, 3, 6, 9, ..., 3n, ...

D) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
0, 3, 6, 9, ..., 3n + 3, ...

Answer: A

148) {1, 5, 9, 13, 17, ...}

A) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
1, 5, 9, 13, 17, ..., 4n + 3, ...

B) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
1, 5, 9, 13, 17, ..., 4n – 3, ...

C) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
1, 5, 9, 13, 17, ..., 3n – 1, ...

D) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
1, 5, 9, 13, 17, ..., 3n + 1, ...

Answer: B

149) {8, 13, 18, 23, 28, ...}

A) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 8, & 13, & 18, & 23, & 28, & \ldots, & 5n+3, & \ldots \end{array}$

B) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 8, & 13, & 18, & 23, & 28, & \ldots, & 5n+2, & \ldots \end{array}$

C) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 8, & 13, & 18, & 23, & 28, & \ldots, & 4n-2, & \ldots \end{array}$

D) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 8, & 13, & 18, & 23, & 28, & \ldots, & 4n+3, & \ldots \end{array}$

Answer: A

150) $\left\{\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \ldots\right\}$

A) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{2}, & \frac{1}{3}, & \frac{1}{4}, & \frac{1}{5}, & \frac{1}{6}, & \ldots, & \frac{1}{n+2}, & \ldots \end{array}$

B) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{2}, & \frac{1}{3}, & \frac{1}{4}, & \frac{1}{5}, & \frac{1}{6}, & \ldots, & \frac{1}{n+1}, & \ldots \end{array}$

C) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{2}, & \frac{1}{3}, & \frac{1}{4}, & \frac{1}{5}, & \frac{1}{6}, & \ldots, & \frac{1}{n}, & \ldots \end{array}$

D) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{2}, & \frac{1}{3}, & \frac{1}{4}, & \frac{1}{5}, & \frac{1}{6}, & \ldots, & \frac{1}{n-1}, & \ldots \end{array}$

Answer: B

151) $\left\{\frac{1}{3}, \frac{3}{5}, \frac{5}{7}, \frac{7}{9}, \frac{9}{11} \ldots\right\}$

A) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{3}, & \frac{3}{5}, & \frac{5}{7}, & \frac{7}{9}, & \frac{9}{11}, & \ldots, & \frac{n+1}{3n-1}, & \ldots \end{array}$

B) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{3}, & \frac{3}{5}, & \frac{5}{7}, & \frac{7}{9}, & \frac{9}{11}, & \ldots, & \frac{2n-1}{2n+1}, & \ldots \end{array}$

C) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{3}, & \frac{3}{5}, & \frac{5}{7}, & \frac{7}{9}, & \frac{9}{11}, & \ldots, & \frac{2n+1}{2n-1}, & \ldots \end{array}$

D) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ \frac{1}{3}, & \frac{3}{5}, & \frac{5}{7}, & \frac{7}{9}, & \frac{9}{11}, & \ldots, & \frac{3n-1}{n+1}, & \ldots \end{array}$

Answer: B

152) {1, 4, 9, 16, 25 ...}

A) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1, & 4, & 9, & 16, & 25, & \ldots, & 2n^2, & \ldots \end{array}$

B) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1, & 4, & 9, & 16, & 25, & \ldots, & n^4, & \ldots \end{array}$

C) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1, & 4, & 9, & 16, & 25, & \ldots, & n^3, & \ldots \end{array}$

D) $\begin{array}{cccccccc} 1, & 2, & 3, & 4, & 5, & \ldots, & n, & \ldots \\ \updownarrow & \updownarrow & \updownarrow & \updownarrow & \updownarrow & & \updownarrow & \\ 1, & 4, & 9, & 16, & 25, & \ldots, & n^2, & \ldots \end{array}$

Answer: D

153) {5, 25, 125, 625, ...}

A) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
5, 25, 125, 625, ..., n^5, ...

B) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
5, 25, 125, 625, ..., 5n, ...

C) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
5, 25, 125, 625, ..., 5^n, ...

D) 1, 2, 3, 4, ..., n, ...
↕ ↕ ↕ ↕ ↕
5, 25, 125, 625, ..., 5^{2n}, ...

Answer: C

We give an expression describing the number that corresponds to the natural number n. Use this expression to describe a one–to–one correspondence between the natural numbers and one of its subsets.

154) 4n – 1

A) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
2, 6, 10, 14, 18 ..., 4n – 1, ...

B) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
1, 5, 9, 13, 17 ..., 4n – 1 , ...

C) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
3, 7, 11, 15, 19 ..., 4n, ...

D) 1, 2, 3, 4, 5, ..., n, ...
↕ ↕ ↕ ↕ ↕ ↕
3, 7, 11, 15, 19 ..., 4n – 1, ...

Answer: D

Describe a one–to–one correspondence between the given set and one of its proper subsets. For example, if we gave you the set {3, 5, 7, 9, 11, ...}, the nth term is 2n +1. You could then write the correspondence by matching the elements of {3, 5, 7, 9, 11, ...} with the elements of the subset {5, 7, 9, 11, 13, ...}. The general correspondence would match 2n + 1 with 2n + 3.

155) {5, 6, 7, 8, ...}

A) 5, 6, 7, 8, ..., n + 4, ...
↕ ↕ ↕ ↕ ↕
6, 7, 8, 9, ..., n + 6, ...

B) 5, 6, 7, 8, ..., n + 5, ...
↕ ↕ ↕ ↕ ↕
4, 5, 6, 7, ..., n + 3, ...

C) 5, 6, 7, 8, ..., n + 4, ...
↕ ↕ ↕ ↕ ↕
6, 7, 8, 9, ..., n + 5, ...

D) 5, 6, 7, 8, ..., n + 4, ...
↕ ↕ ↕ ↕ ↕
4, 5, 6, 7, ..., n + 3, ...

Answer: C

156) {6, 8, 10, 12, ...}

A) 6, 8, 10, 12, ..., 2n + 8, ...
↕ ↕ ↕ ↕ ↕
8, 10, 12, 14, ..., 2n + 6, ...

B) 6, 8, 10, 12, ..., 2n + 4, ...
↕ ↕ ↕ ↕ ↕
7, 9, 11, 13, ..., 2n + 6, ...

C) 6, 8, 10, 12, ..., 2n + 5, ...
↕ ↕ ↕ ↕ ↕
8, 10, 12, 14, ..., 2n + 7, ...

D) 6, 8, 10, 12, ..., 2n + 4, ...
↕ ↕ ↕ ↕ ↕
8, 10, 12, 14, ..., 2n + 6, ...

Answer: D