ExamPath

CLASS 9 MATHEMATICS · FBISE · UNIT 3

Unit 3: Sets and Relations — Advanced Practice

20 multiple-choice questions Suggested time: **20 minutes** 1 mark each

Name: Date: Score: / 20

Circle one answer for each question. The answer key with explanations is on the last pages, so try every question before you check. These are practice questions, not official FBISE papers.

1. For R = {(2, 1), (4, 3), (2, 2)}, why is Dom R = {2, 4}?

(A) The domain is the set of all numbers in R
(B) The domain is the set of second elements
(C) The domain is the set of first elements, written without repeats
(D) The domain is {1, 2, 3}

2. In a class of 80 students, 40 like English, 34 like Mathematics and 9 like both. How many like neither?

(A) 9
(B) 15
(C) 26
(D) 65

3. For overlapping sets A and B, n(A ∪ B) equals:

(A) n(A) × n(B)
(B) n(A) + n(B)
(C) n(A) − n(B)
(D) n(A) + n(B) − n(A ∩ B)

4. What is the set of common elements of A and A′?

(A) The set A
(B) The null set
(C) The universal set
(D) An infinite set

5. Find x and y if (x − 3y, 5x + 1) = (4, 6).

(A) x = 1, y = 1
(B) x = −1, y = 1
(C) x = 1, y = −1
(D) x = 2, y = −2/3

6. The number of binary relations in A × B is:

(A) n(A × B)
(B) 2 n(A × B)
(C) n(A) + n(B)
(D) $2^{n(A \times B)}$

7. If A − B = φ and B − A = φ, then:

(A) A = B
(B) A ∩ B = φ
(C) A is a proper subset of B
(D) A and B are disjoint

8. If n(A) = 3 and n(B) = 2, how many binary relations are there in A × B?

(A) 32
(B) 64
(C) 6
(D) 8

9. The inverse of a relation R is defined as:

(A) $R^{-1} = \varphi$
(B) $R^{-1} = \{(b, a) \mid (a, b) \in R\}$
(C) $R^{-1} = \{(a, b) \mid a = b\}$
(D) $R^{-1} = \{(a, a) \mid a \in A\}$

10. Which statement about the ordered pair (a, 1) is correct?

(A) It has only one element
(B) It is the same as the set {a, 1}
(C) It can be written as (1, a)
(D) It cannot be written as (1, a), because the order matters

11. If A = {x | x ∈ N, x < 3} and B = {y | y ∈ W, y < 2}, find n(A × B).

(A) 6
(B) 4
(C) 3
(D) 2

12. Why is A × B generally not equal to B × A?

(A) Because the order inside each ordered pair matters, so (a, b) ≠ (b, a)
(B) Because they have different numbers of elements
(C) Because A and B are always disjoint
(D) Because the product is always empty

13. If A ∪ B = A and A ∩ B = B, what is the relation between A and B?

(A) A and B are overlapping
(B) A ⊂ B
(C) B ⊆ A
(D) A and B are disjoint

14. Two sets are called overlapping when:

(A) one is a subset of the other
(B) they have exactly the same elements
(C) they have a common element and neither is a subset of the other
(D) they have no common element

15. Which is the distributive property of union over intersection?

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

16. Why is n(A) + n(B) too large for n(A ∪ B) when A and B overlap?

(A) The common elements are counted twice
(B) The elements of B are negative
(C) The sets are empty
(D) The elements of A are not counted

17. If A ⊂ B, what is A − B?

(A) B
(B) B − A
(C) A
(D) φ

18. For non-empty sets A and B, $n(A \times B)$ equals:

(A) $2^{n(A)}$
(B) $n(A) - n(B)$
(C) $n(A) + n(B)$
(D) $n(A) \times n(B)$

19. If A has n elements, how many elements does $A \times A$ have?

(A) n^2
(B) $n + n$
(C) $2n$
(D) 2^n

20. For non-empty sets A and B, when is $A \times B = B \times A$?

(A) Never
(B) Only when A and B are disjoint
(C) Only when A = B
(D) Always

Answer key

Unit 3 · Advanced Practice

1 C	**2** B	**3** D	**4** B	**5** C
6 D	**7** A	**8** B	**9** B	**10** D
11 B	**12** A	**13** C	**14** C	**15** A
16 A	**17** D	**18** D	**19** A	**20** C

Explanations

1. C. The domain is the set of first elements, written without repeats
The first elements are 2, 4 and 2. A set does not repeat elements, so Dom R = {2, 4}.

2. B. 15
n(E ∪ M) = 40 + 34 − 9 = 65. So 80 − 65 = 15 students like neither.

3. D. n(A) + n(B) − n(A ∩ B)
The common elements are counted twice in n(A) + n(B), so n(A ∩ B) is subtracted once.

4. B. The null set
The elements of A are never present in A′, so the two sets have nothing in common.

5. C. x = 1, y = −1
Equal pairs give x − 3y = 4 and 5x + 1 = 6. So x = 1 and 1 − 3y = 4, which gives y = −1.

6. D. $2^{n(A \times B)}$
Every binary relation is a subset of A × B, and a set with n elements has 2^n subsets.

7. A. A = B
A − B = φ means A ⊆ B. B − A = φ means B ⊆ A. Both together give A = B.

8. B. 64
n(A × B) = 3 × 2 = 6, so the number of relations is 2^6 = 64.

9. B. $R^{-1} = \{(b, a) \mid (a, b) \in R\}$
The inverse swaps the two elements of every ordered pair of R.

10. D. It cannot be written as (1, a), because the order matters
Swapping the elements changes an ordered pair, so (a, 1) ≠ (1, a).

11. B. 4
A = {1, 2} and B = {0, 1}. So n(A × B) = 2 × 2 = 4.

12. A. Because the order inside each ordered pair matters, so (a, b) ≠ (b, a)
Both products have the same number of pairs, but the pairs are written in opposite orders. So they are different sets in general.

13. C. B ⊆ A
A ∪ B = A means B adds nothing new to A. A ∩ B = B means every element of B is in A. So B ⊆ A.

14. C. they have a common element and neither is a subset of the other
Overlapping sets share at least one element, and neither contains the other.

15. A. A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C)
Union distributes over intersection as A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C).

16. **A. The common elements are counted twice**

Elements in A ∩ B are counted once in n(A) and once in n(B). We subtract n(A ∩ B) to count them once.

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17. **D. φ**

Every element of A is also in B, so nothing is left after removing B's elements. The result is the empty set.

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18. **D. n(A) × n(B)**

The Cartesian product pairs every element of A with every element of B.

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19. **A. n^2**

$n(A \times A) = n \times n = n^2$.

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20. **C. Only when A = B**

The two products have the same ordered pairs only when A and B are the same set.

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