**Comprehensive Exam Study Guide**

**B.Ed. in Secondary Education –**

**Math concentration**

**Introduction**

The College of Education administers a comprehensive exam to all students that they must pass with a score of 80% or better to be approved to enter student teaching/internship to ensure that students have the content, pedagogical, and professional knowledge needed to be successful in student teaching and in entering the teaching career.

Students take the exam just prior to student teaching/internship, and will not be allowed to register for student teaching/internship unless a passing score (> 80 %) has been obtained. Students will have two opportunities to pass the test.

The test is administered on Blackboard and students can get immediate feedback on their performance in the test.

In the following section, the guide offers a specification of the topics covered in the exam questions, the Qatar curriculum standards the questions are related to and sample questions for each concentration.

**B.Ed. in Secondary Education - Math concentration**

**Part 1: Content**

The exam includes 60 items in mathematics content including the following topics:

* Number & Operations : (Rules of powers, simplifying fractions, complex numbers , matrixes, prime numbers, average speed, problem solving related to quantities).
* Algebra (quadratic functions, vertex of quadratic functions, solving system of equations, problem solving and functions, solving algebraic expression, functions, patterns, inequalities, logarithm functions translation of graphs, problem solving and functions, composite of functions).
* Geometry and Trigonometry : ( deduction and deductive reasoning, congruent triangles, similar triangles, volume and lateral area of the solids such as , cube, cone, prism, …., trigonometric functions (sin, cos, tan, ….), theories of circle, geometric translations such as rotation, reflection, …), Pythagoras theory).
* Statistics & Probability : (Rules of probabilities, scatterplot and correlations, mean, median, mode, tree diagram, problem solving related to probability)
* Calculus : limits, continuity, rules of differentiation for function, trigonometric function , exponential functions) , rules of integration (for function, trigonometric function , exponential functions), Maclaurin series,
* Discrete Math : (matrixes and problem solving, A stem-and-leaf plot is shown below, diagrams, combinations and permutations)

*Topics and curriculum standards covered in the exam*

|  |  |
| --- | --- |
| **Grade Level** **(10-11-12)** | **Qatar National Standards / Mathematics** |
| 11 | Number & Algebra 3.1 |
| 10 | Number & Algebra 3.1 |
| 12 | Number & Algebra 7.1 (advanced) |
| 12 | Number & Algebra 7.1 (advanced) |
| - | Number & Algebra |
| 10 | Number & Algebra 2.5 |
| 10 | Number & Algebra 1.1 |
| 10 | Number & Algebra 3.1 |
| 11 | Number & Algebra 5.3 |
| 10 | Number & Algebra 5.13 |
| 11 | Number & Algebra 5.6 ( Problemsolving) |
| 10 | Number Algebra 5.2 (reasoning) |
| 10 | Number & Algebra 4.9 (problem solving) |
| 10 | Number &Algebra 4.5 (reasoning) |
| 12 | Number & Algebra 5.2 (reasoning) |
| 10 | Number & Algebra 4.2 |
| 11 | Number & Algebra 4.1 |
| 11 | Number & Algebra 5.5 |
| 11 | Number & Algebra 5.18 |
| 12 | Number & Algebra 7.2(advanced) |
| 12 | Number & Algebra 5.2 (advanced) |
| 12 | Number & Algebra 3.1 (advanced)Reasoning |
| 12 | Number & Algebra 3.1 (advanced)Reasoning |
| 10 | Number & Algebra 2.3 |
| 11 | Geometry & Measurement 8.1(Reasoning) |
| 10 | Geometry & Measurement 6.2(Reasoning) |
| 10 | Geometry & Measurement 6.3(Reasoning) |
| 10 | Geometry & Measurement 7.1 |
| 10 | Geometry & Measurement 6.9(Reasoning) |
| 10 | Geometry & Measurement 6.5 |
| 11 | Geometry & Measurement 8.9 |
| 11 | Geometry & Measurement 9.1 |
| 10 | Geometry & Measurement 7.1(Problem solving) |
| 11 | Geometry & Measurement 9.1 |
| 11 | Geometry & Measurement 8.2(Problem solving) |
| 10 | Geometry & Measurement 7.1(Problem solving) |
| 11 | Probability & statistics 12.5 |
| 12 | Probability & statistics 11.1 |
| 11 | Probability & statistics 12.2 |
| 10 | Probability & statistics 9.1 |
| 12 | Probability & statistics 10.5 |
| 12 | Probability & statistics 10.4 |
| 10 | Probability & statistics 8.4 |
| 10 | Probability & statistics 8.1Reasoning |
| 11 | Probability & statistics 12.8 |
| 10 | Probability & statistics 8.4Reasoning |
| 11 | Numbers and Algebra & Calculus (advanced) 6.4 |
| 11 | Numbers and Algebra & Calculus (advanced) 6.2 |
| 12 | Numbers and Algebra & Calculus (advanced) 8.2 |
| 12 | Numbers and Algebra & Calculus (advanced) 7.8 |
| 11 | Numbers and Algebra & Calculus (advanced) 6.4 |
| 11 | Numbers and Algebra (advanced) 4.2 |
| 12 | Numbers and Algebra & Calculus (advanced) 8.8 |
| 12 | Numbers and Algebra & Calculus (advanced) 7.1 |
| 11 | Probability & Statistics 13.1 |
| 11 | Probability & Statistics 12.8 |
| 11 | Probability & Statistics 8.5 |
| 11 | Numbers & Algebra 4.7 |
| 12 | Probability & Statistics 10.11 |
| 11 | Numbers a& Algebra 6.1 |

**Part 2: Pedagogy**

The second part of the exam includes 20 items related to pedagogy including the following:

* Teaching strategies for mathematical content (concepts, generalizations, algorithms and skills, problem solving).
* Mathematical thinking (Deductive and inductive thinking).
* Mathematical communication.
* Mathematical reasoning.
* Mathematical representations.
* Mathematical connection.
* Mathematical problem solving.
* Assessment in mathematics education.

*Sample questions*

1. What is the simplest form of

$\frac{5x^{3}y+20x^{2}y^{2}+20xy^{3}}{5xy}$ ?

**A** (*x+2*)2

**B** (*x+2y*)2

**C** *x2* + *y2*

**D** *x2* + 4*y2*

1. A family will travel 350 miles from their house in order to reach Dallas, TX. Which inequality can be used to find all possible values of *t*, the time it will take this family to reach Dallas in hours, if they travel at an average speed of at least *r* miles per hour?
2. *t* ≤ 350*r*
3. *t >* $\frac{r}{350}$
4. *t* ≤
5. *t >* 350*r2*
6. Which of the following facts would be sufficient to prove that triangles *ABC* and *DBE* are similar?

 

**A** $\overbar{CE}$ and $\overbar{BE}$ are congruent.

**B** ∠*ACE* is a right angle.

**C** $\overbar{AC}$ and $\overbar{DE}$ are parallel.

**D** **∠** *A* and **∠** *B* are congruent

1. To get home from work, Curtis must get on one of the three highways that leave the city. He then has a choice of four different roads that lead to his house. In the diagram below, each letter represents a highway, and each number represents a road.

**Highway**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **A** | **B** | **C** |
| **1** | **A1** | **B1** | **C1** |
| **2** | **A2** | **B2** | **C2** |
| **3** | **A3** | **B3** | **C3** |
| **4** | **A4** | **B4** | **C4** |

 **Road**

If Curtis randomly chooses a route to travel home, what is the probability that he will travel Highway B and Road 4?

**A** 1/16

**B** 1/12

**C** 1/4

**D** 1/3

1. An equation for a tangent to the graph of y = arcsin $\frac{y}{2}$ at the origin is
2. x-2y = 0
3. x-y = 0
4. x = 0
5. y = 0
6. A stem-and-leaf plot is shown below.



Which **best** describes the distribution of the data?

1. Skewed right
2. Skewed left
3. Symmetric
4. Bimodal
5. Which of the following teaching strategies is/are most appropriate to teach mathematical generalizations?
6. Learning by guided discovery.
7. Lecturing
8. Direct present
9. A & C