وزارة التربية والتعليم
MINISTRY OF EDUCATION

ترخيص المهن التعليمية
Educational Professions Licensure

Mathematics

Study Guide- Specialization Test

(Grade 3 – Grade 8) Teachers

Year 2020

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Educational Professions Licensure

Mathematics Grade 3 to 8 Study Guide

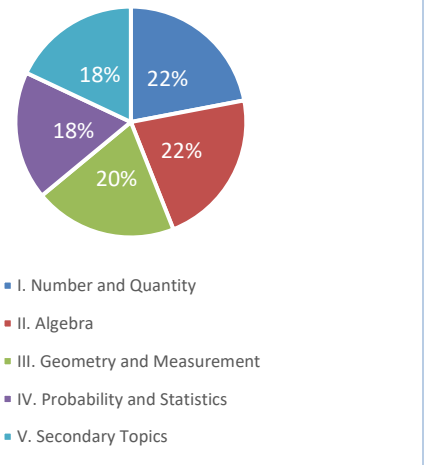
The Teacher Licensing System in the Ministry of Education of the United Arab Emirates is one of the educational priorities that aim at optimizing investment in teachers in order to help them to achieve the objectives of the ministry and to improve educational outcomes.

The Mathematics Test for teachers is one of the Professional teacher's license requirements for those who are teaching from grades 3 through 8 in mathematics.

Test Overview

Test Name	Mathematics Test Grade 3-8
Number of questions	100
Test Duration	2 and ½ hours
Format of questions	Multiple Choice questions/ Fill in the blank
Test Delivery	Computer delivered

Content Domain	Approximate Percentage of Test	Approximate Number of Questions
I. Number and Quantity	22%	22
II. Algebra	22%	22
III. Geometry and Measurement	20%	20
IV. Probability and Statistics	18%	18
V. Secondary Topics	18%	18



Test specifications

I. Number and Quantity

1. **Structure of Numerical Systems:**
   a. Place value
   b. Order relationships
   c. Relationships between operations
   d. Multiple forms of numbers
   e. Factors and divisibility
   f. Prime and composite
   g. Prime factorization
   h. Properties of numerical systems

2. **Operations of integers, rational numbers, decimals, percentage, ratio and proportional relationships:**
   a. Order of operations
   b. Identity and inverse elements
   c. Associative, commutative, and distributive properties
   d. Absolute value
   e. Operations of signed numbers
   f. Multiple representations of numerical operations
   g. Analyzing algorithms for addition, subtraction, multiplication, and division of integers and rational numbers
   h. Number operations and their inverses

3. **Application of integers, rational numbers, decimals, percentage, ratio and proportional relationships:**
   a. Application problems using numerical systems
   b. Average rate of change
   c. Using estimation for verifying reasonableness of solutions

I. Number and Quantity cont.

4. **Structure of Real Number System:**
   a. Rational and irrational numbers and operations
   b. Properties of the real number system
   c. Operations and their inverses
   d. The real number line
   e. Roots and powers
   f. Laws of exponents
   g. Scientific notation
   h. Using number properties to prove theorems

II. Algebra

1. **Patterns and Modeling:**
   a. Patterns in numeric, geometric, or tabular form
   b. Symbolic notation
   c. Patterns created by functions
   d. Finite and infinite sequences and series

2. **Expressions:**
   a. Concept of a variable
   b. Evaluating expressions
   c. Relationship between computational algorithms and algebraic processes
   d. Express direct and inverse relationships algebraically
   e. Expressing one variable in terms of another
   f. Manipulating and simplifying algebraic expressions
   g. Solving equations
   h. Modeling with algebraic expressions

II. Algebra cont.

3. **Functions and Relations:**
   a. Differences between functions and relations
   b. Multiple forms of functions
   c. Generating and interpreting graphs
   d. Properties of functions and relations
   e. Piecewise and composite functions
   f. Graphs of functions and their transformation

4. **Linear Functions and Relations:**
   a. Relationships between linear models and rate of change
   b. Direct variation
   c. Graphs of linear equations
   d. Slope and intercepts of lines
   e. Equation of a line
   f. Systems of linear equations and inequalities
   g. Modeling using linear functions and systems

5. **Quadratic Functions and Relations:**
   a. Solving quadratic equations and inequalities
   b. Real and complex roots of quadratic equations
   c. Graphs of quadratic equations
   d. Maximum and minimum problems
   e. Modeling with quadratic relations, functions, and systems

6. **Polynomial, Rational, Exponential, and Absolute Value Functions and Relations:**
   a. Exponential growth and decay
   b. Inverse variation
   c. Modeling using rational functions
   d. Properties of polynomial, rational, and absolute value

II. Algebra cont.

   e. Numerical solutions to exponential, polynomial, rational, and absolute value functions

III. Geometry

1. **Structure of Euclidean Geometry:**
   a. Axiomatic systems
   b. Undefined terms, postulates, and theorems
   c. Relationships between, points, lines, rays, angles, and planes
   d. Triangle congruence conditions
   e. Similar triangles
   f. Geometric constructions

2. **Two-dimentional objects:**
   a. Relationships among triangles, quadrilaterals, and other polygons
   b. Identifying plane figures given characteristics of sides, angles, diagonals
   c. Pythagorean theorem
   d. Special right triangle relationships
   e. Arcs, angles, segments associated with polygons and circles
   f. Area of composite shapes
   g. Modeling involving two-dimensional objects

3. **Three-Dimensional Objects:**
   a. Relationship among area and volume for three-dimensional figures
   b. Perspective drawings and projections
   c. Cross-sections, conic sections and nets
   d. Deriving properties of three-dimensional objects from two-dimensional shapes
   e. Modeling involving three-dimensional objects

III. Geometry cont.

4. **Coordinate and Transformational Geometries:**
   a. Representation of geometric figures in the coordinate plane
   b. Concepts of distance, midpoint, slope, and parallel and perpendicular lines to classify and analyze figures
   c. Translations, rotations, reflections, glide reflections, and dilation
   d. Types of symmetry
   e. Properties of tessellations
   f. Transformations in the coordinate plane
   g. Using transformational geometry to prove and solve problems

5. **Concepts and procedures related to measurement:**
   a. Using appropriate units of measurement
   b. Unit conversions within and across measurement systems
   c. Solving problems involving; length, area volume, mass, capacity, density, time, temperature, angles, and rates of change
   d. Similar plane figures and indirect measurement
   e. Effects of changing linear dimensions on measures of length, area, or volume
   f. Effects of measurement error and rounding on computed quantities

IV. Statistics and Probability

1. **Descriptive Statistics and Data:**
   a. Charts, graphs, and tabular data representations
   b. Determine appropriate sampling techniques and gathering data
   c. Inferences, interpolations, and extrapolations from a data set

2. **Measures:**
   a. Measures of central tendency
   b. Dispersion
   c. Frequency distributions
   d. Percentile scores
   e. Effects of data transformations on measure of central tendency and variability
   f. Interpreting correlation
   g. Problems involving linear regression models

3. **Probability:**
   a. Representations of possible outcomes for probabilistic problems
   b. Counting strategies
   c. Compute theoretical probability for simple and compound events
   d. Simulations to analyze probability
   e. Understand connections between geometry and probability

V. Secondary Topics

1. **Discrete Mathematics:**
   a. Properties of sets
   b. Recursive patterns and relations
   c. Finite Differences
   d. Iteration
   e. Linear programming
   f. Properties of matrices
   g. Applications of graphs and trees

2. **Trigonometry:**
   a. Degree and radian measure
   b. Right triangle trigonometry
   c. Law of sines and cosines
   d. Properties and graphs of trigonometric functions and inverses
   e. Amplitude, period, and phase shift
   f. Trigonometric identities
   g. Trigonometric functions

3. **Conceptual basis of calculus:**
   a. Concept of a limit
   b. Relationship between slope and rates of change
   c. Understand how the derivative relates to maxima, minima, points of inflection, and concavity of curves
   d. Relationship between integration and area under a curve
   e. Modeling basic problems using differentiation and integration

Sample Questions

1. A student measures the width of a piece of paper to be 36 centimeters. The actual width of the paper is 35.75 centimeters. What is the relative error in this measurement?

قام أحد الطلاب بقياس عرض قطعة ورق فوجده يساوي 36 سنتيمتراً. العرض الفعلي لقطعة الورق هو 35.75 سنتيمتراً. ما هو الخطأ النسبي في القياس؟

A. 0.99%

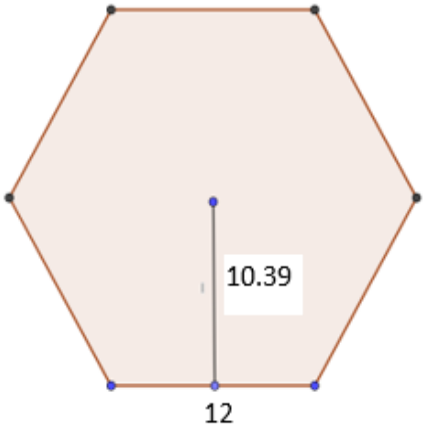
B. 0.7%

C. 0.007%

D. 0.1%

2. What is the area of the regular hexagon shown below with a midpoint height of 10.39 and a base of 12?

ما مساحة السداسي المنتظم الموضح أدناه إذا كان الإرتفاع عند نقطة المنتصف يساوي 10.39 وطول القاعدة 12؟



A. 124.68

B. 374.04

C. 748.08

D. 72

3. Which of the following is equivalent to the value of the digit 3 in the number below?

أي مما يلي يكافئ قيمة الرقم 3 في العدد أدناه؟

792.134

A. $\frac{3}{10}$

B. 3×10

C. 3×100

D. $\frac{3}{100}$

4. Which of the following is not a function?

أي مما يلي ليس دالة؟

A. $x = 3$

B. $y = |x|$

C. $x = 3y$

D. $y = 4$

5. A construction company is building a new villa development with the property of each house measuring 30 meters wide. If the length of the road is 345 meters, how many villas can be built on the road?

تقوم شركة إنشاءات ببناء مجمع سكني يتكون من فيلات، بحيث يكون عرض كل فيلا 30 متراً. إذا كان طول الشارع هو 345 متراً، كم عدد الفيلات التي يمكن بنائها بمحاذاة الشارع؟

A. 11

B. 11.5

C. 12

D. 12.5

6. A bakery had 252 customers last week. This week, that number increased to 378. What is the percentage of increase in customers?

لدى مخبز 252 زبوناً الأسبوع الماضي. ازداد عدد الزبائن هذا الأسبوع ليصل إلى 378 زبوناً. ما نسبة االزيادة في عدد الزبائن؟

A. 50%

B. 33%

C. 26%

D. 12%

7. If a, b, and c are consecutive odd integers, which expression must not be odd?

إذا كانت a وb وc ثلاثة أعداد فردية متتالية، أي تعبير يجب أن يكون ليس فردياً ؟

A. $2(c - a) + b$

B. $a(b + c)$

C. abc

D. $(a + b) - c$

8. Which of the following is equivalent to the expression below after it is simplified?

أي مما يلي يكافئ التعبير أدناه بعد التبسيط؟

$$(5x^2 - 3x + 4) - (2x^2 - 7)$$

A. $3x^2 - 3x - 3$

B. $x - 3$

C. $3x^2 - 3x + 11$

D. x^5

9. What is the value of the expression below? ما قيمة التعبير أدناه؟

$$7^2 - 3 \times (4 + 2) + 15 \div 5$$

A. 43

B. 40.2

C. 58.2

D. 34

10. What is the solution for the equation below on the given interval?

ما حل المعادلة أدناه في الفترة المُعطاة ؟

$$\tan(x) + 1 = 0, \text{ where } 0 \leq x \leq 2\pi$$

A. $x = \frac{5\pi}{4}, \frac{\pi}{4}$

B. $x = \frac{3\pi}{4}, \frac{5\pi}{4}$

C. $x = \frac{3\pi}{4}, \frac{7\pi}{4}$

D. $x = \frac{5\pi}{4}, \frac{7\pi}{4}$

11. If Fatima takes 48 minutes to walk 3 kilometers, how long should it take her to walk 5 kilometers maintaining the same speed?

إستغرقت فاطمة 48 دقيقة للسير مسافة 3 كيلومتر، كم من الزمن ستستغرق للسير 5 كيلومتر إذا كانت تسير بنفس السرعة؟

A. 67 minutes

B. 80 minutes

C. 60 minutes

D. 77 minutes

12. Which of the following augmented matrices presents the system of equations below?

أي من المصفوفات الموّسعة التالية تُمثل نظام المعادلات أدناه؟

$$2x - 3y + z = -5$$
$$4x - y - 2z = -7$$
$$-x + 2z = -1$$

A. $\begin{bmatrix} 2 & -3 & 1 & -5 \\ 4 & -1 & -2 & -7 \\ -1 & 0 & 2 & -1 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 4 & -1 \\ -3 & -1 & 0 \\ 1 & -2 & 2 \\ -5 & -7 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 4 & -1 & -1 \\ -3 & -1 & 0 & -7 \\ 2 & -2 & 2 & -5 \end{bmatrix}$

D. $\begin{bmatrix} 2 & -3 & 1 \\ 4 & -1 & -2 \\ -1 & 0 & 2 \end{bmatrix}$

13. What is the solution set for the inequality shown below?

ما مجموعة حل المتباينة أدناه؟

$$-3(x + 4) \geq x + 8$$

A. $x \leq -5$

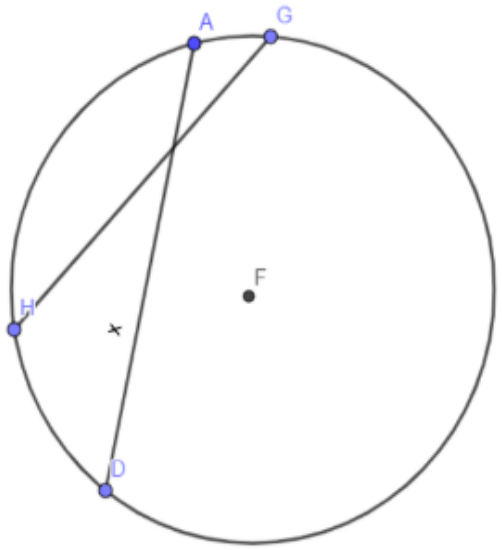
B. $x \geq -5$

C. $x \geq 2$

D. $x = 4$

14. Two chords intersect inside a circle. The lengths of the two parts of one chord are 9 and 16. The lengths of the second chord are 6 and x. What is the value of x?
Object not drawn to scale.

يتقاطع وتران داخل دائرة. طولي جزئي أحد الأوتار هما 9 و 16، وطولي جزئي الوتر الثاني هما 6 و x.
ما قيمة x ؟
الرسم أدناه ليس بمقياس رسم.



A. 8

B. 13

C. 24

D. 19

15. A sphere has a volume of $288\pi\ cm^3$. What is the radius and surface area of the same sphere?

حجم كرة هو $288\pi\ cm^3$، ما هو طول نصف القطر ومساحة سطح نفس الكرة؟

A. Radius is 6 meters and surface area is $12\pi\ cm^2$

نصف القطر 6 أمتار ومساحة السطح $12\pi\ cm^2$

B. Radius is 6 meters and surface area is $144\pi\ cm^2$

نصف القطر 6 أمتار ومساحة السطح $144\pi\ cm^2$

C. Radius is 36 meters ans surface are is $144\pi\ cm^2$

نصف القطر 36 متراً ومساحة السطح $144\pi\ cm^2$

D. Radius is 36 meters and surface area is $12\pi\ cm^2$

نصف القطر 36 متراً ومساحة السطح $12\pi\ cm^2$

16. What is the 42nd item in the pattern below?

ما رمز العنصر ال 42 في النمط أدناه؟

&®®∞∑&®®∞∑&.....

A. ®

B. &

C. ∑

D. ∞

17. If you are representing the value of a given stock at monthly intervals, which graphical representation should be used to best represent the trend of the stock?

إذا كنت تريد تمثيل قيمة مخزون مُعين في فترات شهرية، أي التمثيلات البيانية التالية هي الأفضل في تمثيل إتجاه قيمة المخزون؟

A. circle graph — التمثيل بالدائرة

B. line graph — التمثيل بالخط المستقيم

C. line plot — التمثيل بالنقاط

D. box plot — الصندوق ذي العارضين

18. In a school, there are 3 girls for every 2 boys. There are 650 students in total. How many students are girls?

في إحدى المدارس توجد 3 بنات مقابل كل ولدين. إذا كان إجمالي عدد طلاب المدرسة (البنات والأولاد) يساوي 650، فكم عدد البنات؟

A. 260

B. 325

C. 130

D. 390

19. What is the trapezoidal approximation for the integral shown below using 4 subintervals?

ما القيمة التقريبية للتكامل أدناه بطريقة شبه المنحرف مستخدماً 4 فترات جزئية؟

$$\int_0^4 \sqrt{x}\,dx$$

A. 5.333

B. 10.293

C. 5.146

D. 12.293

20. Solve the following equation.

حل المعادلة التالية.

$$9x + x - 7 = 16 + 2x$$

A. $x = 3$

B. $x = \frac{23}{8}$

C. $x = \frac{9}{8}$

D. $x = -4$

21. Aya gets paid a weekly salary and a commission for every sale that she makes. The table below shows the number of sales and her salary for different weeks.

تحصل آية على راتب أسبوعي وعمولة مقابل كل عملية بيع تقوم بها. الجدول أدناه يُوضح عدد المبيعات وراتبها لأسابيع مختلفة.

Sales	2	7	4	8	المبيعات
Salary	3800	5800	4600	6200	الراتب

Which of the following equations represents Aya's weekly salary?

أي من المعادلات التالية تُمثل راتب آية الأسبوعي؟

A. $y = 400x - 3000$

B. $y = 900x - 2000$

C. $y = 400x + 3000$

D. $y = 900x + 2000$

22. At the Dubai World Cup, what is the probability of you selecting at random, the winner and the runner-up from a race of 4 horses and determining which is the winner?

في بطولة كأس العالم بدبي لسباق الخيول، ما احتمال أن تختار عشوائياً الفائزين بالمركز الأول والثاني في سباق يتكون من أربعة خيول وتحديد الفائز؟

A. $\frac{1}{16}$

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. $\frac{1}{12}$

23. What does cos(90° − *A*) equal if *A* is the degree measure of a acute angle and sin *A* = 0.8?

ما قيمة cos(90° − *A*) إذا كانت A زاوية حادة قياسها بالدرجات و sin *A* = 0.8 ؟

A. 0.6

B. 0.8

C. 0.2

D. 0.4

24. Which of the following figures is not a polygon?

أي من الأشكال التالية ليس مضلعاً؟

A. Circle الدائرة

B. Triangle المثلث

C. Rhombus المُعيّن

D. Hexagon سداسي الأضلاع

25. What is the slope of the line tangent to the graph $y = x^3 - 4$ at the point where $x = 2$?

ما ميل المماس للمنحنى $y = x^3 - 4$ عند النقطة $x = 2$؟

A. 12

B. 8

C. 4

D. −4

Answer Key

Question	Answer
1	B
2	B
3	D
4	A
5	A
6	A
7	B
8	C
9	D
10	C
11	B
12	A
13	A
14	C
15	B
16	A
17	B
18	D
19	C
20	B
21	C
22	D
23	B
24	A
25	A