Academics Mathematics Placement
Study Guide
Overview

The time for the CNA-Qatar Academic Mathematics Placement (AMP) is two hours. The AMP has two parts:

Part 1 can be completed with the use of a calculator and a calculator will be provided for your use. You will not be permitted to use your own calculator or mobile phone. The calculator that will be provided is the Casio fx-85ES, as pictured to the right. It is your responsibility to know how to use this calculator. You will not receive help with the calculators while you are writing the AMP.

Part 2 must be completed WITHOUT the use of a calculator.

The AMP will have 75 multiple choice questions. There are four choices for answers to each question. Questions will cover the following topics:

- Rounding and Place Value
- Order of Operations
- Decimals and Percents
- Fractions
- Algebraic Expressions
- Equations
- Word Problems
- Formula Rearrangement
- Geometry
- Graphing
- Exponents
- Factoring
- Rational Expressions
- Trigonometry

This study guide contains sample questions from some of the topics listed above, and represents the average level of difficulty for each section. Not all topics are covered.

Vocabulary

Below is a list of words that you may see in the AMP. It is advised that you know the meaning of these words before writing the test.

<table>
<thead>
<tr>
<th>Area</th>
<th>Double</th>
<th>Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>Equation</td>
<td>Radius</td>
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<tr>
<td>Circumference</td>
<td>Evaluate</td>
<td>Round</td>
</tr>
<tr>
<td>Completely</td>
<td>Factor</td>
<td>Simplify</td>
</tr>
<tr>
<td>Composite</td>
<td>Increase</td>
<td>Slope</td>
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<tr>
<td>Coordinates</td>
<td>Length</td>
<td>Solution</td>
</tr>
<tr>
<td>Decrease</td>
<td>Measure</td>
<td>Solve</td>
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<tr>
<td>Denominator</td>
<td>Multiply</td>
<td>Twice</td>
</tr>
<tr>
<td>Diameter</td>
<td>Numerator</td>
<td>Value</td>
</tr>
<tr>
<td>Digit</td>
<td>Perimeter</td>
<td>Volume</td>
</tr>
<tr>
<td>Distance</td>
<td>Point</td>
<td>x-intercept</td>
</tr>
<tr>
<td>Divide</td>
<td>Power</td>
<td>y-intercept</td>
</tr>
</tbody>
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PART 1
Consists of 55 questions that can be completed with a calculator.

1. Find the GCF and LCM of 32 and 48.

2. Evaluate: \(250 \left( 1 + 0.15 \times \frac{7}{12} \right)\)

3. Change 120 kilograms (kg) to milligrams (mg).

4. What is 12% of 25?

5. 31% of what number is 15.5?

6. 16 is what percent of 25?

7. Simplify:
   a) \(-x^3y + 4xy^3 - (xy^3 - 9x^2y)\)
   b) \(ab(b^2 - 4ac)\)
   c) \((4 - 7x)^2\)
   d) \((5a^3b^4)^2\)
   e) \(\left( \frac{x^{-y}z}{x^2yz^0} \right)^{-2}\)

8. Solve for \(x\): \(4(x + 2) - (x - 1) = 9 - 3x\)

9. Five more than twice a number is 19. What is the number?

10. A price for a pair of shoes is 400 QR. The price is decreased by 30%. What is the new price?
11. Factor: 
   a) \(3x^2 - 5x - 2\) 
   b) \(12x^3y + 6x^4y^2 + 3x^2y\) 
   c) \(4x^2 - 9y^2\)

12. Simplify: 
   a) \(\frac{x^2 + 4x + 4}{x^2 - x - 6}\) 
   b) \(\frac{m}{3n} - \frac{2m}{15n}\) 
   c) \(\frac{y^2 - 9}{2y^2 + 10y} \times \frac{y^2 + 5y}{y^2 + y - 6}\)

13. Find the perimeter:
   ![Diagram of a triangle with sides 8, 10, and 12.8]

14. Find the area:
   ![Diagram of a rectangle with sides 10.2 and 5.1]

15. What is the height of the box if the volume is 150?
   ![Diagram of a box with dimensions 20, 3, and h]
16. What is the slope of the line given by the equation $3x - 9y = -18$?

17. What is the x-intercept of the line given by the equation $3x - 9y = -18$?

18. What is the position at $t = 10$ seconds?

19. Using the graph in Question 18, at what time is the position 3 m?

20. Find the measure of $\angle C$

21. In $\triangle SRT$, $\angle R = 90^0$, $r = 17.5$, $t = 4.90$. Calculate the length of the missing side.

22. What is the circumference of a circle that has a diameter of 4 units?
PART 2
Consists of 20 questions to be completed without a calculator.

1. Round to ONE decimal place: 5.6498

2. Which digit is in the tens place? 10.63

3. Evaluate

   (a) $3 \times 2 - 2^3 \div 8 + 1$
   (b) $\frac{7}{9} \div \frac{35}{18}$
   (c) $\frac{4}{5} - \frac{3}{10}$
   (d) $\frac{3}{8} - 1\frac{2}{3}$
   (e) $\frac{7}{2} - \frac{1}{3}$

4. Complete the table:

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>a ( \frac{5}{9} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b ( \frac{112}{3} % )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c ( \frac{9}{8} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td>0.06%</td>
</tr>
<tr>
<td>e</td>
<td>1.26</td>
<td></td>
</tr>
</tbody>
</table>

5. Write an equation to represent the statement: “9 less than twice a number is 17”

6. Simplify $\frac{x^4 \cdot x^9}{x^2}$

7. Solve the formula for w: $P = 2(L + w)$
ANSWER TO SAMPLE QUESTIONS

Part 1

1. To find the GCF: \( 32 = 2 \times 2 \times 2 \times 2 \times 2 \)
   \( 48 = 2 \times 2 \times 2 \times 2 \times 3 \)

   Common factors... so the GCF is \( 2 \times 2 \times 2 \times 2 = 16 \)

To find the LCM: multiples of 32: 32, 64, 96, 128...
multiples of 48: 48, 96, 144, 192...

96 is the smallest common multiple, so the LCM is 96

2. \( 250 \left(1 + 0.15 \times \frac{7}{12}\right) = 250 \left(1 + 0.15 \times 0.58333...\right) \)
   \( = 250(1 + 0.0875) \)
   \( = 250(1.0875) \)
   \( = 271.875 \)

3. 120 kg = 120 kg \( \times \frac{1000 \text{ g}}{1 \text{ kg}} \) = 120 000 g \( \times \frac{1000 \text{ mg}}{1 \text{ g}} \) = 120 000 000 mg

4. 12% \times 25 = x
   0.12 \times 25 = x
   3 = x

5. 31% \times x = 15.5
   0.31x = 15.5
   \( \frac{0.31x}{0.31} = \frac{15.5}{0.31} \)
   \( x = 50 \)
6. \(16 = x \times 25\)
\[
\begin{align*}
16 &= 25x \\
25 &= 25 \\
0.64 &= x \\
64\% &= x
\end{align*}
\]

7. (a) \(-x^2y + 4xy^3 - (xy^3 - 9x^2y)\)
\[
\begin{align*}
&= -x^2y + 4xy^3 - xy^3 + 9x^2y \\
&= 8x^2y + 3xy^3
\end{align*}
\]

(b) \(ab(b^2 - 4ac) = ab^3 - 4a^2bc\)

(c) \((4 - 7x)^2 = (4 - 7x)(4 - 7x)\)
\[
\begin{align*}
&= 16 - 28x - 28x + 49x^2 \\
&= 16 - 56x + 49x^2
\end{align*}
\]

(d) \((5a^5b^3)^2 = (5)^2 (a^5)^2 (b^3)^2\)
\[
= 25a^{10}b^6
\]

(e) \(\left(\frac{x^{-1}y^4z}{x^2yz^6}\right)^2 = \left(\frac{x^{-1}y^4z}{x^2yz^6}\right)\left(\frac{x^2yz^6}{1}\right) = \left(\frac{x^{-1}y^4z}{x^2yz^6}\right)\left(\frac{x^2}{y^2z^2}\right) = \left(\frac{x^3}{y^3z}\right) = \frac{x^6}{y^6z^2}\)

8. \(4(x + 2) - (x - 1) = 9 - 3x\)
\[
\begin{align*}
4x + 8 - x + 1 &= 9 - 3x \\
4x - x + 3x &= 9 - 8 - 1 \\
6x &= 0 \\
\frac{6x}{6} &= \frac{0}{6} \\
x &= 0
\end{align*}
\]
9. Let \( x \) = the number. Then: \( 2x + 5 = 19 \)
\[
2x = 19 - 5 \\
2x = 14 \\
2x = \frac{14}{2} \\
x = \frac{14}{2} = 7
\]

10. Let \( x \) = new price. Then: \( x = 400 - 30\% \times 400 \)
\[
x = 400 - 0.30 \times 400 \\
x = 400 - 120 \\
x = 280
\]

The new price of the shoes is 280 QR.

11. (a) \( 3x^2 - 5x - 2 \)
\[
3x^2 - 6x + x - 2 \\
(3x^2 - 6x) + (x - 2) \\
3x(x - 2) + 1(x - 2) \\
(3x + 1)(x - 2)
\]

(b) \( 12x^3y^3 + 6x^4y^2 + 3x^2y \)
\[
= 3x^2y(4xy^2 + 2x^2y + 1)
\]

(c) \( 4x^2 - 9y^2 \)
\[
= (2x + 3y)(2x - 3y)
\]
12. (a) \[ \frac{x^2 + 4x + 4}{x^2 - x - 6} = \frac{(x + 2)(x + 2)}{(x - 3)(x + 2)} \]
\[ = \frac{x + 2}{x - 3} \]

(b) \[ \frac{m}{3n} - \frac{2m}{15n} = \frac{5m}{15n} - \frac{2m}{15n} \]
\[ = \frac{3m}{15n} \]
\[ = \frac{m}{5n} \]

(c) \[ \frac{y^2 - 9}{2y^2 + 10y} \times \frac{y^2 + 5y}{y^2 + y - 6} = \frac{(y + 3)(y - 3)}{2y(y + 5)} \times \frac{y(y + 5)}{(y + 3)(y - 2)} \]
\[ = \frac{y - 3}{2(y - 2)} \]

13. \[ P = 8 \text{ cm} + 10 \text{ cm} + 12.8 \text{ cm} = 30.8 \text{ cm} \]

14. \[ A = l \times w \]
\[ = (10.2 \text{ cm})(5.1 \text{ cm}) \]
\[ = 52.02 \text{ cm}^2 \]

15. \[ V = l \times w \times h \]
\[ 150 \text{ m}^3 = (20 \text{ m})(3 \text{ m})(h) \]
\[ 150 \text{ m}^3 = (60 \text{ m}^2)(h) \]
\[ 150 \text{ m}^3 = (60 \text{ m}^2)(h) \]
\[ \frac{60 \text{ m}^2}{60 \text{ m}^2} = \frac{h}{2.5 \text{ m}} \]
\[ 2.5 \text{ m} = h \]
16. \( 3x - 9y = -18 \)

\[
-9y = -3x - 18 \\
\frac{-9y}{-9} = \frac{-3x - 18}{-9} \\
y = \frac{1}{3}x + 2
\]

So the slope of the line is \( \frac{1}{3} \).

17. \( 3x - 9y = -18 \)

\[
3x - 9(0) = -18 \\
3x = -18 \\
\frac{3x}{3} = \frac{-18}{3} \\
x = -6
\]

18. 5 m

19. 3 seconds

20. \( \cos \angle C = \frac{9}{15} \)

\[
\angle C = \cos^{-1} \left( \frac{9}{15} \right) \\
\angle C = 53^\circ
\]

21. \[
S \quad 17.5 \\
R \quad 4.9 \quad T
\]

\[
17.5^2 = 4.9^2 + s^2 \\
306.25 = 24.01 + s^2 \\
306.25 - 24.01 = s^2 \\
282.24 = s^2 \\
\sqrt{282.24} = s \\
16.8 \text{ m} = s
\]

22. If the diameter is 4 units, then the radius is \( \frac{4}{2} = 2 \) units. The circumference is then \( C = 2\pi r = 2\pi(2) = 12.57 \) units.
Part 2

1. 5.6

2. 1

3. (a) \[3 \times 2 - 2^2 \div 8 + 1 = 6 - 32 \div 8 + 1 = 6 - 4 + 1 = 3\]

(b) \[\frac{7}{9} \div \frac{35}{18} = \frac{7}{9} \times \frac{18}{35} = \frac{7}{9} \times \frac{9 \times 2}{7 \times 5} = \frac{2}{5}\]

(c) \[\frac{4}{5} - \frac{3}{10} = \frac{4 \times 2}{5 \times 2} - \frac{3}{10} = \frac{8}{10} - \frac{3}{10} = \frac{5}{10} = \frac{1}{2}\]

(d) \[2 \frac{3}{8} - 1 \frac{2}{3} = (2 - 1) + \left(\frac{3}{8} - \frac{2}{3}\right)\]

Cannot subtract 16 from 9...
We need to borrow from the 1

The 1 becomes \[\frac{24}{24}\]

\[= 1 + \left(\frac{9}{24} - \frac{16}{24}\right) = \frac{24}{24} + \frac{9}{24} - \frac{16}{24} = \frac{17}{24}\]

(e) \[\frac{7}{9} - \frac{1}{12} = \frac{7}{9} - \frac{2 \times 4}{3 \times 4} = \frac{7}{9} - \frac{8}{12} = \frac{7}{9} - \frac{12}{12} = \frac{4}{3}\]
### 4. Fraction, Decimal, Percent

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) $\frac{5}{9}$</td>
<td>$5 \div 9 = 0.555\ldots$</td>
<td>$0.555\ldots \times 100 = 55.56%$</td>
</tr>
<tr>
<td>(b) $\frac{11 \times 3 + 2}{3} \div 100$</td>
<td>$7 \div 60 = 0.11666\ldots$</td>
<td>$11\frac{2}{3}%$</td>
</tr>
<tr>
<td></td>
<td>$= \frac{35}{3} \times \frac{1}{100}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$= \frac{35}{300} = \frac{35 \div 5}{300 \div 5} = \frac{7}{60}$</td>
<td></td>
</tr>
<tr>
<td>(c) $\frac{9}{8}$</td>
<td>$9 \div 8 = 1.125$</td>
<td>$1.125 \times 100 = 112.5%$</td>
</tr>
<tr>
<td>(d) $0.06 \div 100$</td>
<td>$0.06 \div 100 = 0.0006$</td>
<td>$0.06%$</td>
</tr>
<tr>
<td></td>
<td>$= \frac{0.06 \times 100}{100 \times 100}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$= \frac{6}{10000} = \frac{6 \div 2}{10000 \div 2}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$= \frac{3}{5000}$</td>
<td></td>
</tr>
<tr>
<td>(e) $\frac{126}{100}$</td>
<td>$1.26$</td>
<td>$1.26 \times 100 = 126%$</td>
</tr>
<tr>
<td></td>
<td>$= \frac{126 \div 2}{100 \div 2} = \frac{63}{50}$</td>
<td></td>
</tr>
</tbody>
</table>

5. Let $x = \text{the number}$, then the equation is $2x - 9 = 17$

6. $\frac{x^4 \cdot x^9}{x^2} = x^{4+9-2} = x^{11}$

7. $P = 2l + 2w$

| | $P - 2l = 2w$ | $P - 2l = 2w$ |
| | $\frac{2}{2} = w$ | $w$ |
| | $\frac{P - 2l}{2} = w$ | $w$ |