Foundation Studies Program
Placement Test
Mathematics

Introductory remarks:

- You are asked to answer 30 multiple choice questions.

- Please answer all question within the allocated time period of 60 minutes.

- Mark your correct answers on the extra sheet which is provided with the questions. No marks will be given for rough work, remarks or other contributions.

- Please leave all items on the desk at the end of the test.
Q1) Choose the most appropriate and complete answer.

The number 5 is
a) a real number, a rational number, a natural number, an integer.
b) a real number, a counting number, a Z-number.
c) an integer and nothing else.
d) nothing from the above is entirely correct.

Q2) Choose the most appropriate and complete answer.

The number $\sqrt{7}$ is
a) a real number, a rational number and a function number.
b) a real number and a rational number.
c) a transcendental number.
d) a real number.

Q3) Choose the most appropriate and complete answer.

The number $\pi = 3.14159...$ is
a) a real number and a rational number.
b) a geometric number.
c) A circle number.
d) nothing from the above is entirely correct.

Q4) If $f(x) = 3x - 1$ and $g(x) = -2x - 1$ then $f(g(2))$ is equal to
a) 0
b) 5
c) -5
d) -16
Q5) If \( f(x) = 3x + 1 = y \) then the inverse function \( f^{-1}(y) \) is equal to
   a) \( f^{-1}(y) = \frac{1}{3}y + \frac{1}{3} \)
   b) \( f^{-1}(y) = \frac{1}{3}y - \frac{1}{3} \)
   c) \( f^{-1}(y) = y + 1 \)
   d) \( f^{-1}(y) = y - 1 \)

Q6) If \( f(x) = 3x + 1 = y \) and \( g(x) = -2x - 5 \) then \( f(x) = g(x) \) for
   a) \( x = \frac{6}{5} \)
   b) \( x = \frac{5}{6} \)
   c) \( x = -\frac{6}{5} \)
   d) \( x = -\frac{5}{6} \)

Q7) The height of a falling object, as a function of the variable \( t \), is given by the function \( h(t) = -0.1 \ t^2 \). Determine the value of \( t \) for which \( h(t) = -4.9 \)
   a) \( t = 0.7 \)
   b) \( t = 2.21 \)
   c) \( t = 7 \)
   d) \( t = 22.1 \)

Q8) A metal block of dimension 5 mm by 10 mm by 20 mm weighs 7.3 grams. Determine the density \( \rho \) of the material from which the block is made:
   a) \( \rho = 0.0073 \ \text{g cm}^{-3} \)
   b) \( \rho = 0.73 \ \text{g cm}^{-3} \)
   c) \( \rho = 7300 \ \text{g cm}^{-3} \)
   d) \( \rho = 7.3 \ \text{g cm}^{-3} \)
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Q9) A straight line is described by the equation \( y = 5x + 3 \). Determine the point at which the line cuts the y-axis

a) (5, 3)  
b) (3, 5)  
c) (0, 3)  
d) (0, -3)

Q10) A straight line is described by the equation \( y = 5x + 3 \). Determine the point at which the line cuts the x-axis

a) \( \left( \frac{3}{5}, 0 \right) \)  
b) \( \left( -\frac{3}{5}, 0 \right) \)  
c) \( (0, -\frac{3}{5}) \)  
d) \( (0, \frac{3}{5}) \)

Q11) For which values of \( x \) is \( f(x) = 5 - x \) equal to \( g(x) = 5x + 2 \)

a) \( x = \frac{1}{2} \)  
b) \( x = \frac{2}{3} \)  
c) \( x = \frac{7}{6} \)  
d) \( x = -\frac{3}{6} \)

Q12) At which points do the graphs of the functions \( f(x) = 15 - 2x \) and \( g(x) = x^2 \) intersect?

a) \( (-3, 21) \) and \( (-1,17) \)  
b) \( (1, 13) \) and \( (3,9) \)  
c) \( (-6,27) \) and \( (2,11) \)  
d) \( (3,9) \) and \( (-5,25) \)
Q13) Evaluate $y = \frac{1}{3} + \frac{2}{5}$

a) $y = \frac{3}{8}$
b) $y = \frac{11}{15}$
c) $y = \frac{6}{5}$
d) none of these

Q14) Evaluate $y = \frac{1}{3} \div \frac{2}{5} = \frac{1}{3} \times \frac{5}{2}$

a) $y = \frac{2}{15}$
b) $y = \frac{5}{6}$
c) $y = \frac{6}{5}$
d) $y = \frac{5}{12}$

Q15) Determine the interval(s) for which $8 - 2x \geq x^2$

a) $(-\infty, -4]$ and $[2, \infty)$
b) $x \leq -4$
c) $x \geq 2$
d) $[-4, 2]$
Q17) A one dimensional motion, as a function of time \( t \), is obtained as \( f(t) = -10 \cdot t^2 + 4 \cdot t + 5 \). Determine the value of \( t \) for which \( f(t) \) is maximal (i.e. determine the vertex):

a) \( t = 1 \)

b) \( t = \frac{9}{20} \)

c) \( t = \frac{1}{5} \)

d) \( t = \frac{1}{40} \)

Q18) If \( \frac{1}{3} \) is divided by 5, and multiplied by \( \frac{7}{2} \) one obtains the result

a) \( \frac{35}{6} \)

b) \( \frac{7}{30} \)

c) \( \frac{2}{55} \)

d) none of these is correct

Q19) Determine the value of \( T = \frac{(1-2)-(5+3)}{1+3\cdot7} \). The result is:

a) \( T = -\frac{2}{5} \)

b) \( T = -\frac{1}{2} \)

c) \( T = -\frac{4}{11} \)

d) \( T = -\frac{3}{22} \)
Q20) For the right angle triangle shown below determine the missing length $x$ of the side of the triangle.

![Right Angle Triangle]

a) $x = 1$

b) $x = 2$

c) $x = 3$

d) $x = 4$

Q21) For the right angle triangle shown below (not drawn to scale) identify the correct definition of the trigonometric function $\cos(\varphi)$ for the angle $\varphi$.

![Right Angle Triangle]

a) $\cos(\varphi) = \frac{8}{17}$

b) $\cos(\varphi) = \frac{15}{17}$

c) $\cos(\varphi) = \frac{8}{15}$

d) $\cos(\varphi) = \frac{15}{8}$
Q22) For the right angle triangle shown below angle $\theta$ has a value of $\theta = 35^\circ$ if measured in degrees. Determine the value of the angle $\varphi$ in degrees.

a) $\varphi = 45^\circ$
b) $\varphi = 55^\circ$
c) $\varphi = 65^\circ$
d) $\varphi = 75^\circ$

Q23) Consider an equilateral triangle (that is a triangle with 2 sides of the same length $x$) and an angle $\varphi$ of value $\varphi = 45^\circ$. Determine the value of $h$ in units of $x$.

Hint: Have $\sin(45^\circ) = \cos(45^\circ) = \frac{1}{\sqrt{2}}$.

a) $h = \frac{x}{\sqrt{2}}$
b) $h = \frac{x}{4\sqrt{2}}$
c) $h = -\sqrt{2} x$
d) $h = -\frac{x}{\sqrt{2}}$
Q24) The inverse function of an exponential function is
   a) 1 divided by the exponential function
   b) the exponential function with the argument x replaced by 1/x
   c) the root function to the base of e
   d) the natural logarithm function

Q25) Consider the exponential function \( \exp(x) \). Which of the following is not correct:
   a) \( \exp(2x) = \exp(x) \cdot \exp(x) \)
   b) \( \frac{1}{2} \exp(x) = \exp(x - \ln(2)) \)
   c) \( \exp(2x) = \exp(x) + \exp(x) \)
   d) \( \frac{1}{x} = \exp(-\ln(x)) \)

Q26) If \( \sin(x) = 0.123 \) then
   a) \( \cos(x) = \sqrt{1 - (0.123)^2} \)
   b) \( \cos(x) = 0.123 \)
   c) \( \cos(x) = \sqrt{1 - (0.877)^2} \)
   d) none of these

Q27) Determine the correct definition of the tangent function in terms of the sin- and cos-functions:
   a) \( \tan(\theta) = \sin(\theta) + \cos(\theta) \)
   b) \( \tan(\theta) = \sin(\theta) - \cos(\theta) \)
   c) \( \tan(\theta) = \sin(\theta) \cdot \cos(\theta) \)
   d) \( \tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} \)
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Q28) For a measurement which has yielded the numbers 6, 3, 5, 2 the mean \( a \) is determined as
a) \( a = 5.5 \)
b) \( a = 5 \)
c) \( a = 4 \)
d) None of these

Q29) Let \( p \) be the probability for event \( A \), and let \( q \) be the probability of event \( B \). Under the assumption that \( A \) and \( B \) are statistically independent the probability \( r \) of event \( A \) or event \( B \) is then determined as
a) \( r = p + q \)
b) \( r = |p - q| \)
c) \( r = p \cdot q \)
d) \( r = p ÷ q \)

Q30) Let \( p \) be the probability for event \( A \), and let \( q \) be the probability of event \( B \). Under the assumption that \( A \) and \( B \) are not statistically independent the probability \( r \) of event \( A \) or event \( B \) is to be determined. Which of the following statements is not correct:

a) \( r \) cannot be obtained uniquely from the information given above.
b) For obtaining the desired probability the information / the probability for event \( A \) and simultaneously event \( B \) is needed.
c) \( r \leq p + q \)
d) such a case cannot be handled by a probability description under any circumstances.