Circle the correct answer in the following questions.

- a

MTCG1018 – Pure Mathematics  Prescreening Specimen Paper    Page 1 of 13
Each question carries 4 marks.

[Total Marks 100]

1) An oblique triangle has …

- a) a right angle
- b) one obtuse angle
- c) two obtuse angles

2) In the triangle below, the value of \( y \) is …

\[
\begin{align*}
&65^\circ \quad 9 \\
&75^\circ \quad x \quad y
\end{align*}
\]

- a) 4.8
- b) 84
- c) 8.4

3) The volume of a cylinder whose height is 6 \( cm \) and diameter 8 \( cm \) is …

- a) 1206 \( cm^3 \)
- b) 302 \( cm^3 \)
- c) 150 \( cm^3 \)

4) If the area of a circle is \( 49\pi m^2 \) then its radius is …

- a) 7 \( m \)
- b) \( \sqrt{7} m \)
- c) 49 \( m \)

5) The graph between class limits and frequency is called …

- a) Histogram
- b) Pie Chart
- c) Bar Chart

6) … is an example of Quantitative-continuous data.
7) If the mean of the following distribution is 9, then the value of \( x \) is …

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a) 2  b) 2.5  c) 20

8) The standard deviation of the data from the sample observations 1, 4, 5, 7, 9 is …

a) 5  b) 3  c) 2

9) If there are 11 books on a shelf, then 6 books can be arranged in … ways.

a) 332640  b) 66  c) 462

10) If a die is thrown once. The probability of getting a prime number is …

a) 0.16  b) 0.3  c) 0.5

11) If A and B are independent events and \( P(A) = \frac{2}{5} \) and \( P(B) = \frac{3}{7} \) then \( P(A \cup B) \) is …
12) If \( P(A \cap B) = \frac{5}{21} \) and \( P(A) = \frac{5}{9} \) then \( P(B|A) = \ldots \)

| a) \( \frac{1}{3} \) | b) \( \frac{3}{7} \) | c) \( \frac{7}{13} \) |

13) … **line test** is used to determine if a graph represents a **function**

| a) Horizontal | b) Oblique | c) Vertical |

14) The ordered pairs … represent a **constant function**

| a) \{ (2, 2), (3, 3), (1, 1) \} | b) \{ (c, 1), (b, 2), (c, 3) \} | c) \{ (1, c), (2, c), (3, b) \} |

15) Given that \( f(x) = x - 2 \) and \( g(x) = 5x + 3 \), then \( f(g(x)) \ldots \)

| a) \( 5x + 1 \) | b) \( 5x - 1 \) | c) \( 6x - 5 \) |

16) The graph of the function \( y = (0.3)^x \) shows ………..
a) Limited growth  
b) decay  
c) Unlimited growth

17) If \( \left( \frac{1}{2} \right)^{3x} = 2^{x-4} \), then the value of \( x \) is…

| a) 1 | b) -2 | c) 3 |

18) The expression for \( \log (xy^2) \) is…

| a) \( 2\log x + 2\log y \) | b) \( 2\log x + \log y \) | c) \( \log x + 2\log y \) |

19) If \( \log_b 2 = 0.69 \), \( \log_b 3 = 1.10 \) and \( \log_b 5 = 1.61 \), then \( \log_b 30 \) is equal to …

| a) 2.4 | b) 3.4 | c) 1.22 |

20) The function \( f(x) = \begin{cases} 
  x - 3 & \text{if } x > 2 \\
  -5 & \text{if } x = 2 \\
  3x - 7 & \text{if } x < 2 
\end{cases} \) is not continuous at \( x = 2 \) because…

| a) \( f(2) \) is not defined | b) \( \lim_{x \to 2} f(x) \) does not exist | c) \( \lim_{x \to 2} f(x) \neq f(2) \) |
21) For the function \( f(x) \) whose graph is given below, the correct statement is…

- a) \( f(3) = \lim_{x \to 3} f(x) \)
- b) \( \lim_{x \to 3} f(x) = 4 \)
- c) \( \lim_{x \to 3} f(x) = \lim_{x \to 3} f(x) = 2 \)

22) The value of \( \lim_{x \to \frac{1}{3}} \left( \frac{9x^2-1}{3x-1} \right) \) is…

- a) 0
- b) 2
- c) 3

23) If \( y = 3x^2 - 5x + 4 \), then \( \frac{dy}{dx} = \ldots \)

- a) \( 6x - 5 \)
- b) \( 3x - 5 \)
- c) \( 6x + 4 \)

24) If \( y = \frac{x^2 - 1}{3x} \), then \( \frac{dy}{dx} = \ldots \)

- a) \( \frac{x^2 - 1}{3x^2} \)
- b) \( \frac{x^2 + 1}{x^2} \)
- c) \( \frac{x^2 + 1}{3x^2} \)

25) The derivative of \( 5\cos^2 3x \) is …

- a) \( 5\cos^2 3x - 15x\sin 6x \)
- b) \( 5\cos^2 3x - 5x\sin 3x \)
- c) \( \cos^2 3x - 15x\sin 6x \)

END OF QUESTIONS
**Formula Sheet**

**Law of Sines and Cosines**

\[
\begin{align*}
\sin \alpha &= \frac{a}{b} = \frac{\sin \beta}{c} = \frac{\sin \gamma}{c} \\
a^2 &= b^2 + c^2 - 2bc \cos \alpha \\
b^2 &= a^2 + c^2 - 2ac \cos \beta \\
c^2 &= a^2 + b^2 - 2ab \cos \gamma \\
\cos \alpha &= \frac{b^2 + c^2 - a^2}{2bc} \\
\cos \beta &= \frac{a^2 + c^2 - b^2}{2ac} \\
\cos \gamma &= \frac{a^2 + b^2 - c^2}{2ab}
\end{align*}
\]

**Perimeter, Area and Volume**

**Triangle:**

\[
\begin{align*}
P &= a + b + c \\
A &= \frac{1}{2}bh
\end{align*}
\]

**Circle:**

- Circumference \((C) = 2\pi r = \pi d\)
- \(A = \pi r^2\)

**Rectangle:**

- \(P = 2l + 2b\)
- \(A = lb\)

**Sector:**

- Length of the arc: \(L = \theta r\) if \(\theta\) is in radians
- \(L = \theta \left( \frac{\pi}{180} \right) r\) if \(\theta\) is in degrees
- Area: \(A = \frac{1}{2} Lr\)
- \(A = \frac{1}{2} \theta r^2\) if \(\theta\) is in radians
- \(A = \theta \left( \frac{\pi}{360} \right) r^2\) if \(\theta\) is in degrees

**Square:**

- \(P = 4s\)
- \(A = s^2\)
Trapezium:
\[ A = \frac{1}{2} (a + b)h \]

Parallelogram:
\[ A = bh \]

Cuboid:
\[ V = l \times b \times h \]
\[ LSA = 2h(l + b) \]
\[ TSA = 2(lb + bh + hl) \]

Pyramid:
\[ V = \frac{1}{3} \text{Area of the base} \times \text{Height} = \frac{1}{3}Ah \]

Cube:
\[ V = S^3 \]
\[ LSA = 4s^2 \]
\[ TSA = 6s^2 \]

Prism:
\[ V = \text{Area of cross section} \times \text{Length} = \left( \frac{1}{2}bh \right)L \]

Cone:
\[ V = \frac{1}{3} \pi r^2 h \]
\[ CSA = \pi rl \]
\[ TSA = \pi r^2 + \pi rl \]

Cylinder:
\[ V = \pi r^2h \]
\[ CSA = 2\pi rh \]
\[ TSA = 2\pi r(r + h) \]
Sphere:

\[ V = \frac{4}{3} \pi r^3 \]
\[ CSA = TSA = 4\pi r^2 \]

Statistics

Relative frequency = \( \frac{f \text{ of the class}}{\sum f} \)

\[ \theta = \text{relative frequency} \times 360^\circ \]

standard deviation = \( \sqrt{\text{Variance}} \)

For ungrouped data

Mean = \( \bar{x} = \frac{\sum x}{n} \)

Sample Variance = \( s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} \)

or \( s^2 = \frac{n \sum x_i^2 - (\sum x_i)^2}{n(n-1)} \)

For grouped data

Mean = \( \bar{x} = \frac{\sum f_i x_i}{\sum f_i} \)

Median = \( L_m + \left[ \frac{\frac{N-cf_m}{f_m}}{i} \right] \)

Where, \( L_m \) = lower class boundary of the median class
\( N \) = the number of cases (items) in the set.
\( cf_m \) = the cumulative frequency before the median class.
\( f_m \) = frequency of the median class

\( i \) = class width or class size

Mode = \( L_{mo} + \left[ \frac{\Delta_1}{\Delta_1 + \Delta_2} \right] i \)

Where, \( L_{mo} \) = lower class boundary of the modal class
\( \Delta_1 \) = the difference between the frequency of the modal class and the frequency of the class before the modal class.
\( \Delta_2 \) = the difference between the frequency of the modal class and the frequency of the class after the modal class.

\( i \) = class width or class size

Sample Variance = \( s^2 = \frac{\sum f_i(x_i - \bar{x})^2}{n-1} \)

or \( s^2 = \frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)} \)

Probability

1) If an experiment can result in any one of \( N \) different equally likely outcomes, and if exactly \( n \) of these outcomes corresponds to event A, then the probability of event A is given by \( P(A) = \frac{n}{N} \)

2) The number of permutations of \( n \) distinct objects is \( n! \)

3) The number of permutations of \( n \) distinct objects taken \( r \) at a time is \( _nP_r \)

4) The number of permutations of \( n \) distinct objects arranged in a circle is \( (n-1)! \)

5) The number of combinations of \( n \) distinct objects taken \( r \) at a time is: \( _nC_r \)

6) If A and B are any two events, then
\[ P(A \cup B) = P(A) + P(B) - P(A \cap B) \]

7) If A and B are two mutually exclusive events, then \( P(A \cup B) = P(A) + P(B) \)
8) If $A$ and $A'$ are complementary events, then $P(A) + P(A') = 1$

9) If in an experiment, the events $A$ and $B$ can both occur, then $P(A \cap B) = P(A) \cdot P(B|A)$

10) If two events $A$ and $B$ are independent, then $P(A \cap B) = P(A) \cdot P(B)$.

**Properties of exponential function**

1) $a^x a^y = a^{x+y}$

2) $(a^x)^y = a^{xy}$

3) $(ab)^x = a^x b^x$

4) $\left(\frac{a^x}{b^x}\right) = \frac{a^x}{b^x}$

5) $\frac{a^x}{a^y} = a^{x-y}$

6) $a^x = a^y$ if and only if $x = y$

7) $a^x = b^x$ if and only if $a = b$

**Definition of logarithmic function**

$y = \log_a x \Leftrightarrow x = a^y$

**Properties of Logarithms**

1) $\log_a (xy) = \log_a x + \log_a y$

2) $\log_a \left(\frac{x}{y}\right) = \log_a x - \log_a y$

3) $\log_a x^b = b \log_a x$

**Quadratic Equation**

Solution of $ax^2 + bx + c = 0$ is given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Rules Of Differentiation**

1. $\frac{d(c)}{dx} = 0$ where $c$ is any constant.

2. $\frac{d}{dx} [a \cdot f(x)] = a \cdot \frac{df(x)}{dx}$

3. $\frac{d(x^n)}{dx} = nx^{n-1}$

4. $\frac{d}{dx} [f(x) \pm g(x)] = f'(x) \pm g'(x)$

5. $\frac{d}{dx} [f(x) \cdot g(x)] = f(x) \cdot g'(x) + g(x) \cdot f'(x)$

or

$$\frac{d}{dx} [u \cdot v] = u \cdot \frac{dv}{dx} + v \cdot \frac{du}{dx}$$

where $u$ and $v$ are two different functions of $x$.

6. if $y = \frac{f(x)}{g(x)}$, then $\frac{dy}{dx} = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$

**General Power form**:

$$\frac{d(u^n)}{dx} = nu^{n-1} \cdot \frac{du}{dx}$$

where $u = f(x)$.

**Derivatives of Trigonometric Functions**

1. $\frac{d}{dx} (\sin u) = \cos u \cdot \frac{du}{dx}$ where $u = f(x)$.

2. $\frac{d}{dx} (\cos u) = -\sin u \cdot \frac{du}{dx}$

3. $\frac{d}{dx} (\tan u) = \sec^2 u \cdot \frac{du}{dx}$

**Derivatives of Exponential Functions**

Let $a$ be any real number but not zero and $u = f(x)$
1. \( \frac{d}{dx} (a^u) = a^u \ln a \cdot \frac{d(u)}{dx} \)

2. \( \frac{d}{dx} (e^u) = e^u \cdot \frac{d(u)}{dx} \)

**Derivatives of Logarithmic Functions**

Let \( a \) be any real number but not zero and \( u = f(x) \)

1. \( \frac{d}{dx} (\log_a u) = \frac{1}{u \ln a} \cdot \frac{d(u)}{dx} \)

2. \( \frac{d}{dx} (\ln u) = \frac{1}{u} \cdot \frac{d(u)}{dx} \)
### ANSWERS

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