MILITARY TECHNOLOGICAL COLLEGE

GFP EXIT EXAM PRESCREENING SPECIMEN PAPER

Module name	Pure Mathematics	Module code	MTCG1018
Total Questions	25	Duration of exam	60 Minutes

Instructions:

- Use of only non- programmable calculators is allowed.
- The figures shown, if any, are only for illustration.
- A list of relevant **Formula sheet** is attached at the back.
- **This exam carries 100% of the overall module mark.**

Circle the correct answer in the following questions. ☞ (a)

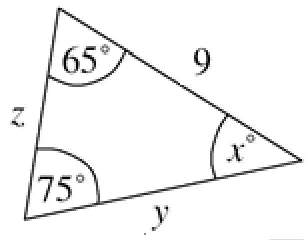
Each question carries 4 marks.

[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 $\boldsymbol{y}$ is …



a) 4.8	b) 84	c) 8.4

3) The **volume** of a cylinder whose height is $6cm$ and diameter $8cm$ 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**.

a)Number of desks	b) Weight of fish	a) Brands of shoes

7) If the mean of the following distribution is 9, then the value of ***x*** is ...

Marks	4	6	$x + 7$	10	15
No. of students	5	10	10	7	8

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 $P(\text{A}) = \frac{2}{5}$ and $P(B) = \frac{3}{7}$ then $P(\text{AUB})$ is ...

a) $\frac{6}{35}$	b) $\frac{23}{35}$	c) $\frac{5}{12}$

12) If $P\ (A\ \cap B) = \frac{5}{21}$ and $P\ (A\ ) = \frac{5}{9}$ then $P(\mathrm{B}|\mathrm{A}) =$…

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) $\{(2, \mathrm{a}), (3, \mathrm{a}), (1, \mathrm{a})\}$	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 $f(g(x))$…

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) $2logx + 2logy$	b) $2logx + logy$	c) $logx + 2logy$

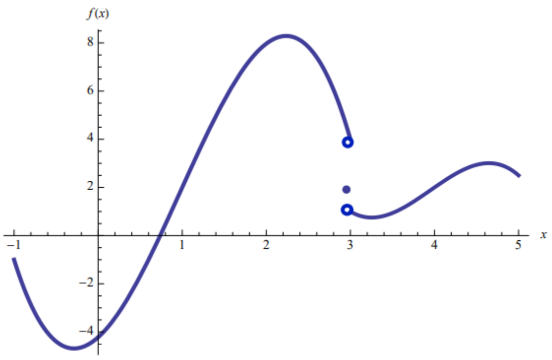
19) If $log_b 2 = 0.69,\ log_b 3 = 1.10\ and\ log_b 5 = 1.61$, then $log_b 30$ is equal to …

a) 2.4	b) 3.4	c) 1.22

20) The function $f(x) = \begin{cases} x - 3 & if\ x > 2 \\ -5 & if\ x = 2 \\ 3x - 7 & if\ x < 2 \end{cases}$ 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) $\frac{x^2 + 1}{3x^2}$

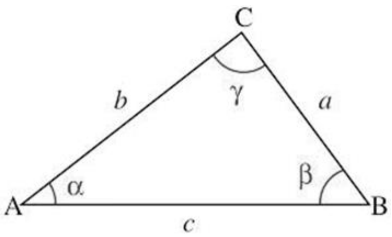
25) The derivative of $5x\cos^2 3x$ is …

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



$$\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}$$

$$a^2 = b^2 + c^2 - 2bc \cos \alpha$$

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

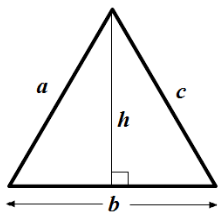
$$\cos \alpha = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos \beta = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos \gamma = \frac{a^2 + b^2 - c^2}{2ab}$$

Perimeter, Area and Volume

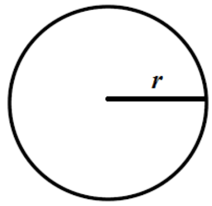
Triangle:



$P = a + b + c$

$A = \frac{1}{2} bh$

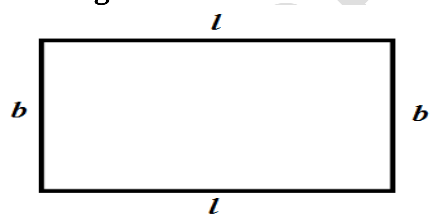
Circle:



Circumference $(C) = 2\pi r = \pi d$

$A = \pi r^2$

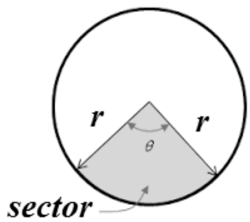
Rectangle:



$P = 2l + 2b$

$A = lb$

Sector:



Length of the arc:

$L = \theta r$ if θ is in radians

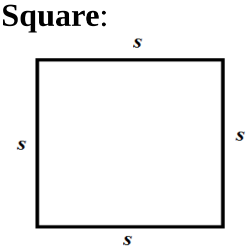
$L = \theta \left(\frac{\pi}{180} \right) r$ if θ is in degrees

Area: $A = \frac{1}{2} Lr$

$A = \frac{1}{2} \theta\ r^2$ if θ isinradians

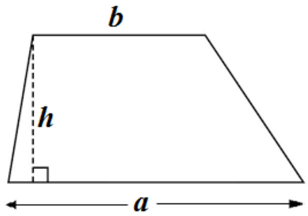
$A = \theta \left(\frac{\pi}{360} \right) r^2$ if θ isindegrees

Square:



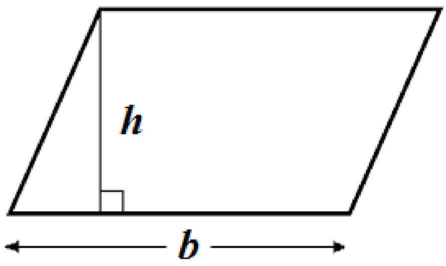
$P = 4s$ $A = s^2$

Trapezium:



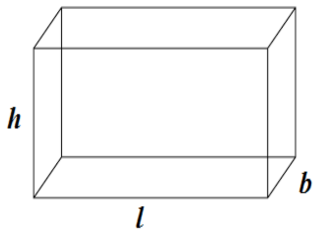
$A = \frac{1}{2}(a+b)h$

Parallelogram:



$A = bh$

Cuboid:

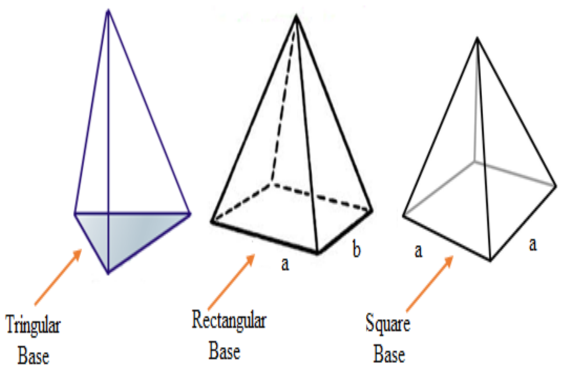


$V = lbh$

$LSA = 2h(l+b)$

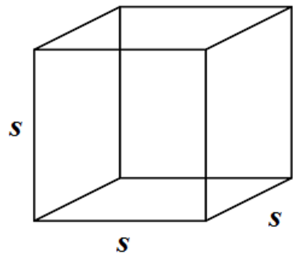
$TSA = 2(lb+bh+hl)$

Pyramid:



$V = \frac{1}{3} Area\ of\ the\ base \times Height = \frac{1}{3}Ah$

Cube:

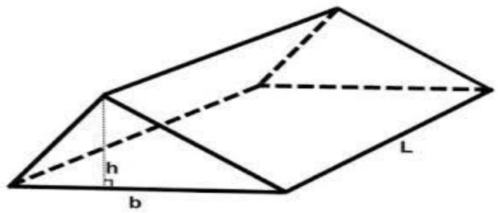


$V = s^3$

$LSA = 4s^2$

$TSA = 6s^2$

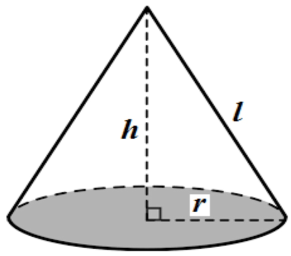
Prism:



$V = Area\ of\ cross\ section \times Length$

$= \left(\frac{1}{2}bh\right)L$

Cone:



$V = \frac{1}{3}\pi r^2 h$

$CSA = \pi r l$

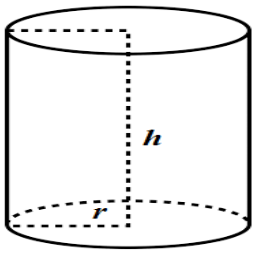
$TSA = \pi r^2 + \pi r l$

Cylinder:

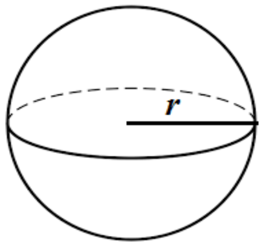
$V = \pi r^2 h$

$CSA = 2\pi r h$

$TSA = 2\pi r(r+h)$



Sphere:



$V = \frac{4}{3}\pi r^3$

$CSA = TSA = 4\pi r^2$

Statistics

$Relative\ frequency = \frac{f\ of\ the\ class}{\sum f}$

$\theta = relative\ frequency \times 360^\circ$

$\text{standard deviation} = \sqrt{\text{Variance}}$

For ungrouped data

Mean = $\bar{x} = \frac{\sum x}{n}$

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

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

For grouped data

Mean = $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

Median = $L_m + \left[\frac{\frac{N}{2} - cf_m}{f_m}\right] i$

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

Δ_1 = the difference between the frequency of the modal class and the frequency of the class **before** the modal class.

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

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

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
$P(A\cap B)=P(A).\,P(B/A)$

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

<u>Properties of exponential function</u>

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

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

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

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

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 $a = b$

<u>Definition of logarithmic function</u>

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

<u>Properties of Logarithms</u>

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

<u>Quadratic Equation</u>

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

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

<u>Rules Of Differentiation</u>

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

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

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

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

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

or

$\frac{d}{dx}[u.v)] = u.\frac{dv}{dx} + v.\frac{du}{dx}$ 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:

$\frac{d(u^n)}{dx} = nu^{n-1}\frac{d\,(u)}{dx}$ where $u = f(x)$.

<u>Derivatives of Trigonometric Functions</u>

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

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

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

<u>Derivatives of Exponential Functions</u>

Let ***a*** be any real number but not zero and

$u = f(x)$

1. $\frac{d}{dx}(a^u) = a^u\, lna. \frac{d\,(u)}{dx}$

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

Derivatives of Logarithmic Functions

Let ***a*** be any real number but not zero and

$u = f(x)$

1. $\frac{d}{dx}(\log_a u) = \frac{1}{u\, lna}\, \frac{d\,(u)}{dx}$

2. $\frac{d}{dx}(ln\, u) = \frac{1}{u}\, \frac{d\,(u)}{dx}$

ANSWERS

Q #	Answer
1	b
2	c
3	b
4	a
5	c

Q #	Answer
6	b
7	a
8	b
9	a
10	c

Q #	Answer
11	b
12	b
13	c
14	a
15	a

Q #	Answer
16	b
17	a
18	c
19	b
20	c

Q #	Answer
21	b
22	b
23	a
24	c
25	a

DRAFT / ROUGH WORK