



MILITARY TECHNOLOGICAL COLLEGE  
GENERAL STUDIES DEPARTMENT  
ACADEMIC YEAR 2016-2017  
GENERAL FOUNDATION PROGRAMME

RE-SIT EXAM

Module Name	Pure Mathematics	Module Code	MTCG1018
Date	26 <sup>th</sup> July 2017	Duration of exam	90 Minutes

**STUDENT DETAILS**

Student ID.		Exam seat number	
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**Instructions:**

- Write the information required on the front page. Use blue / black ink or ball-point pen.
- Students should not keep any helping / study materials with them. Copying, cheating and any kind of malpractices in the examination are strictly prohibited.
- Use of only non- programmable calculators is allowed.
- Answer the questions in the space provided. Extra sheets will not be allowed or provided.
- All necessary working should be shown in Section B, otherwise marks for method will be lost.
- The figures shown, if any, are only for illustration.
- **Do not open** this question paper until the invigilator has told you to do so.

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<b>MARK DISTRIBUTION</b>			
Section	No. of Questions × Marks per Question = Total Marks Allocated	1 <sup>st</sup> Marking	2 <sup>nd</sup> Marking
A	$20 \times 1 = 20$ Marks		
B	$6 \times 5 = 30$ Marks		
Total = 50 Marks		/50	/50
<b>Final Marks</b>		/50	

1<sup>st</sup> Marker  
Name and Signature

2<sup>nd</sup> Marker  
Name and Signature

## Section-A

Answer all the following twenty questions.

Each question carries one mark.

[Total Marks 20]

Encircle the correct answer in the following questions.

Example: 30% of 60 is .....

(a) 18

(b) 50

(c) 1800

(1) Which of the following ordered pairs are Functions?

(a)  $\{(b,1),(b,2),(b,3)\}$

(b)  $\{(a,2),(b,2),(c,2)\}$

(c)  $\{(1,1),(1,2),(2,3)\}$

(2) If  $f(x) = -x + 5$  then  $f(-3) = \dots\dots\dots$

(a) 8

(b) 2

(c) -8

(3) If  $f(x) = x - 4$  then  $f^{-1}(x) = \dots\dots\dots$

(a) 4

(b)  $x - 4$

(c)  $x + 4$

(4)  $e^x(e^{-x} + 1) = \dots\dots\dots$

(a)  $1 - e^x$

(b)  $1 + e^x$

(c)  $e^{-x^2} + e^x$

(5) If  $\log_3 x = 2$  then the value of  $x$  is .....

(a) 8

(b) 9

(c) 6

(6) The science of collecting, summarizing, and analyzing data is called .....

- (a) Statistics                      (b) Survey                      (c) Parameter

(7) The weight of students measured in kilograms are classified as .....

- (a) Qualitative data              (b) Discrete Data              (c) Continuous data

(8) The median of the following distribution: 48, 49, 52, 53, 48, 54, 51 is .....

- (a) 51                                  (b) 53                                  (c) 48

(9) The class size of the given distribution is

<b>Seconds</b>	<b>Frequency</b>
41 - 45	3
46 - 50	8
51 - 55	9
56 - 60	5

- (a) 8                                      (b) 21                                      (c) 5

(10) ..... is an arrangement of distinct objects in specific order.

- (a) Permutation                      (b) Combination                      (c) Frequency distribution

(11) If one die has 6 outcomes then two dice have .....outcomes

- (a) 12                                      (b) 6                                      (c) 36

(12) The probability of an event which absolutely (certainly) will happen is .....

- (a) 1                                      (b) 0                                      (c) 2

(13) If average of 3 numbers is 7 then sum of the numbers is .....

(a) 10

(b) 21

(c) 4

(14) If a car travels 4 hours at an average speed of 80 *Km/hr* then it travels .....

(a) 320 *Km*

(b) 76 *Km*

(c) 20 *Km*

(15) If the area of a square is 36 *cm*<sup>2</sup> then the side is .....

(a) 24 *cm*

(b) 12 *cm*

(c) 6 *cm*

(16) If the radius of a sector is 2 *cm* and corresponding arc length is  $4\pi$  *cm* then angle ' $\theta$ ' subtended at centre is .....

(a)  $4\pi$

(b)  $2\pi$

(c)  $\pi$

(17) A cone with a height of 12 *cm* and a radius 5 *cm*. What is its slant height (L)?

(a) 6 *cm*

(b) 13 *cm*

(c) 10 *cm*

(18) The polar angle for the point (0, 3) is .....

(a)  $90^\circ$

(b)  $-90^\circ$

(c)  $0^\circ$

(19) The total symbols used in the binary number system are .....

(a) 0

(b) 1

(c) 2

(20) .....number system is with base 10

(a) Octal

(b) Decimal

(c) Hexadecimal

## **Section-B**

**Answer all the following six questions. Show your solution step by step.**

**Each question carries five marks.**

**[Total Marks 30]**

**(1a)** Let ' $f$ ' and ' $g$ ' be the functions defined by  $f(x) = x + 1$  and  $g(x) = x - 1$ .

Find  $g(f(-2))$

**[3 Marks]**

**Solution:**

**(1b)** Solve  $(x - 1)^3 = 8$  for ' $x$ '.

**[2 Marks]**

**Solution:**

(2a) If a principal  $P$  is invested at an annual rate  $r$  compounded  $n$  times a year,

then the amount  $A$  at the end of the  $t$  years is given by  $A = P\left(1 + \frac{r}{n}\right)^{nt}$ .

Suppose 5000 RO is deposited in the account paying 4% interest per year compounded quarterly (four times per year). Find the amount in the account after 6 years with no withdrawals.

[2 Marks]

**Solution:**

(2b) Solve:  $\log_{10}(5 - 3x) = 3\log_{10} 2$

[3 Marks]

**Solution:**

(3) Find the variance, standard deviation and coefficient of variation for the following distribution:

<b>Seconds</b>	<b>Frequency</b>
51 - 55	2
56 - 60	7
61 - 65	8
66 - 70	4

**[5 Marks]**

**Solution:**

**(4a)** A batch of 20 components contains 4 defective components. If a component is drawn at random from the batch then tested, and then a second component is drawn at random, calculate the probability of having one defective component if the manner of drawing is

- i)** with replacement
- ii)** without replacement.

**[3 Marks]**

**Solution:**

**(4b)** An aircraft travels 6000 *nautical miles* in 5 *hours* and 30 *minutes*. Find its average speed.

**[2 Marks]**

**Solution:**



(5a) Find the average of first four natural numbers.

[1 Mark]

**Solution:**

(5b) If the total surface area of a cube is  $54 \text{ cm}^2$ , find its volume.

[3 Marks]

**Solution:**

(5c) The Cartesian coordinates  $(3, -3)$  lies in which quadrant?

[1 Mark]

**Answer:**

(6a) Convert the Polar coordinates  $P(3, 135^\circ)$  to Cartesian coordinates  $P(x, y)$ .

[2 Marks]

**Solution:**

(6b) Convert  $(504)_8$  to the decimal number system.

[1.5 Marks]

**Solution:**

(6c) Convert  $(23)_{10}$  to the binary number system.

[1.5 Marks]

**Solution:**

**END OF QUESTIONS**

# Formula Sheet

## Properties of exponential function

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

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

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

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

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

$$6) a^x = a^y \text{ if and only if } x = y$$

$$7) a^x = b^x \text{ if and only if } a = b$$

## Definition of logarithmic function

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

## Properties of Logarithms

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

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

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

## Statistics

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

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

$$\text{Coefficient of variation} = \frac{s}{\bar{x}} \times 100\%$$

## For ungrouped data

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

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

## For grouped data

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

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

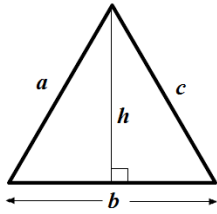
$$\text{Mode} = L_{mo} + \left[ \frac{\Delta_1}{\Delta_1 + \Delta_2} \right] i$$

$$Q_1 = L_{Q_1} + \left[ \frac{\frac{N}{4} - cf_{Q_1}}{f_{Q_1}} \right] i$$

$$Q_3 = L_{Q_3} + \left[ \frac{\frac{3N}{4} - cf_{Q_3}}{f_{Q_3}} \right] i$$

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

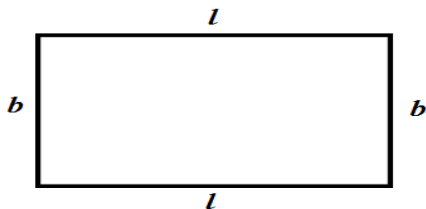
**Triangle:**



$$P = a + b + c$$

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

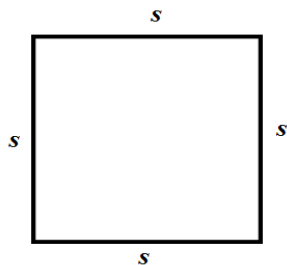
**Rectangle:**



$$P = 2l + 2b$$

$$A = lb$$

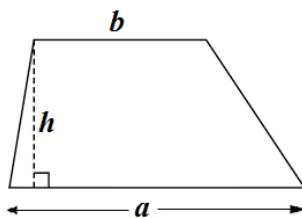
**Square:**



$$P = 4s$$

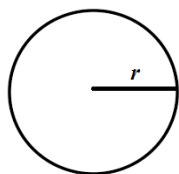
$$A = s^2$$

**Trapezium:**



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

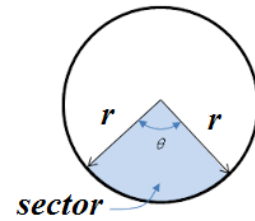
**Circle:**



$$\text{Circumference (C)} = 2\pi r = \pi d$$

$$A = \pi r^2$$

**Sector:**



Length of the arc:

$$L = \theta r \quad \text{if } \theta \text{ is in radians}$$

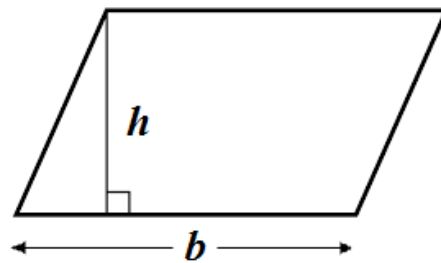
$$L = \theta \left( \frac{\pi}{180} \right) r \quad \text{if } \theta \text{ is in degrees}$$

Area:

$$A = \frac{\theta}{2} r^2 \quad \text{if } \theta \text{ is in radians}$$

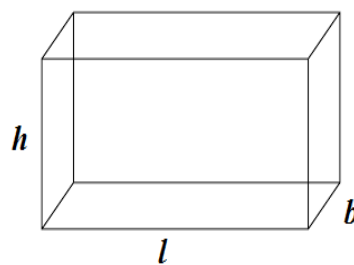
$$A = \theta \left( \frac{\pi}{360} \right) r^2 \quad \text{if } \theta \text{ is in degrees}$$

**Parallelogram:**



$$A = bh$$

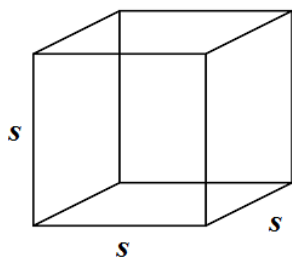
**Cuboid:**



$$V = lbh$$

$$LSA = 2h(l + b)$$

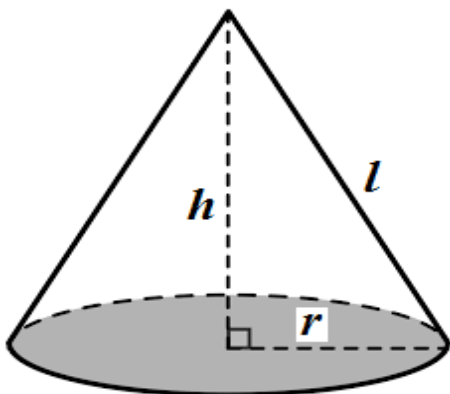
$$TSA = 2(lb + bh + hl)$$

**Cube:**

$$V = s^3$$

$$LSA = 4s^2$$

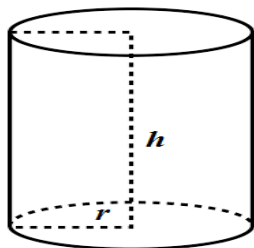
$$TSA = 6s^2$$

**Cone:**

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

$$CSA = \pi r l$$

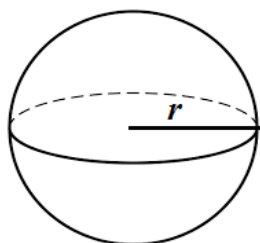
$$TSA = \pi r^2 + \pi r l$$

**Cylinder:**

$$V = \pi r^2 h$$

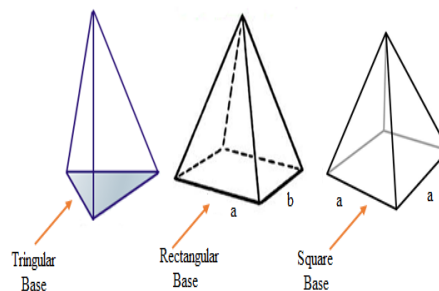
$$CSA = 2 \pi r h$$

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

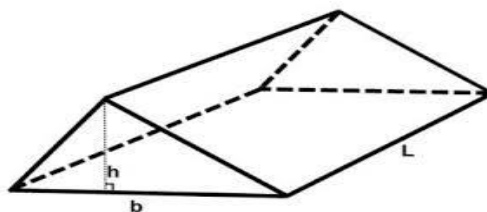
**Sphere:**

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

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

**Pyramid:**

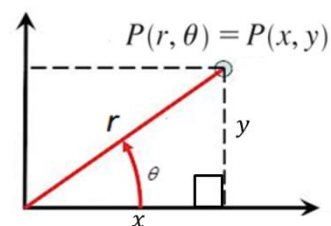
$$V = \frac{1}{3} \text{Area of the base} \times \text{Height} = \frac{1}{3} A h$$

**Prism:**

$$V = \text{Area of the base} \times \text{Height} = \left( \frac{1}{2} b h \right) L$$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \tan^{-1} \left( \frac{y}{x} \right)$$



# **DRAFT / ROUGH WORK**