



DR WADA'S TUTORIALS INTERNAL EXAMINATION

CANDIDATE
NAME

BSSE SCIENTIFIC MATHEMATICS

1237/02

PAPER 2

2025 FINAL EXAMINATION

2 hours 30 minutes

Candidates answer on the Question Paper

INSTRUCTIONS

- Answer **all** questions.
- Write your names in the spaces provided at the top of this page
- Write in dark blue or black pen.
- Write your answer to each question in the spaces provided.
- You may use HB pencil for any diagrams, graphs or rough working.
- Do **not** use staples, paper clips, highlighters, glue or correction fluid.
- Do **not** write in any barcodes.
- Electronic calculators may be used.

INFORMATION

- The total mark for this paper is 80.
- You may lose marks if you do not show your working or if you do not use appropriate units.
- The number of marks is given in brackets [] at the end of each question or part question.

MARKS:

List of formulas

Equation of a circle with centre (a, b) and radius r . $(x - a)^2 + (y - b)^2 = r^2$

Curved surface area, A , of cone of radius r , sloping edge l . $A = \pi r l$

Surface area, A , of sphere of radius r . $A = 4\pi r^2$

Volume, V , of pyramid or cone, base area A , height h . $V = \frac{1}{3}Ah$

Volume, V , of sphere of radius r . $V = \frac{4}{3}\pi r^3$

Quadratic equation For the equation $ax^2 + bx + c = 0$,
 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Binomial theorem $(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$,
where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n - 1)d$
 $S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n - 1)d\}$

Geometric series $u_n = ar^{n-1}$
 $S_n = \frac{a(1 - r^n)}{1 - r} \quad (r \neq 1)$
 $S_\infty = \frac{a}{1 - r} \quad (|r| < 1)$

Identities $\sin^2 A + \cos^2 A = 1$
 $\sec^2 A = 1 + \tan^2 A$
 $\operatorname{cosec}^2 A = 1 + \cot^2 A$

Formulas for $\triangle ABC$ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
 $a^2 = b^2 + c^2 - 2bc \cos A$
 $\Delta = \frac{1}{2}ab \sin C$

1. Write $5.\dot{2}\dot{9}\dot{7}$ as a fraction in its simplest form

.....[3]

2. Determine the amount of interest earned on P2500 investment if it is invested at 5.25% annual interest compounded monthly for four years

.....[4]

3. Simply $\frac{r^2\sqrt{p}q^{\frac{1}{2}}}{q^{\frac{-1}{2}}p^2r^5}$, leaving your answer in the form $r^ap^bq^c$ and state the values of a, b and c

.....[3]

4. Given that $p = \log_2 3$ and $q = \log_2 5$ determine the following in terms of p and q

(a) $\log_2 45$

.....[3]

(b) $\log_2 0.3$

.....[4]

5. Calculate the inverse of the matrix $\begin{pmatrix} 2 & 3 & 4 \\ -3 & -3 & -2 \\ -2 & 1 & -1 \end{pmatrix}$

.....[7]

6. Express $\frac{5x+13}{(x+2)(x+3)}$ in partial fractions.

.....[5]

7. Show that $x+3$ is a factor of $-2x^3 - 3x^2 + 23x - 12$

.....[2]

8. The edges of a polystyrene cube are of length 20 cm, correct to the nearest centimetre.

(a) (i) wrote down the upper bound of the length of an edge of the cube

.....[1]

(ii) calculate the maximum possible volume of the cube

.....[2]

(b) The polystyrene has a mass of 264 g correct to the nearest gram
Calculate the minimum possible density of the polystyrene

.....[3]

9. Given the functions

$$f(x) = 2x^2 + 1x$$

$$g(x) = \frac{12x + 4}{3}$$

Find

(a) The value of $fg(2)$

.....[3]

(b) Find the inverse of $g(x)$

.....[2]

10. Solve the equation $2\cos^2\theta = 3\sin\theta$ for $0^\circ \leq \theta \leq 360^\circ$.

.....[6]

11. The frequency table below shows shoe sizes for a group of 18 football players

| Shoe size | Number of players |
|----------------|-------------------|
| 7 | 2 |
| 8 | 6 |
| $8\frac{1}{2}$ | 3 |
| 9 | 5 |
| 10 | 2 |

- (a) A player is chosen at random from the group to attend a coaching clinic
What is the probability that the player chosen wears size 8?

.....[1]

- (b) The player who is chosen to attend a coaching clinic wears size 9. From the remaining players in the group, two players are chosen at random to attend a regional training camp.
Calculate the probability that

- (i) They both wear size 9

.....[3]

- (ii) One wears size 8 and the other wears size 10

.....[3]

12. In a term, a school collects P2800 from each pre-school pupil and 4900 from lower primary pupil as tuition fee.

- (a) There are x pre-school pupils and y lower primary school pupils in the term
Express in terms of x and/or y the

(i) Amount of money the school collects from lower pre-school pupils

.....[1]

(ii) Amount of money the school collects from primary school pupils

.....[1]

(iii) Total amount of money the school collects from pre-school pupils and lower primary school pupils in the term.

.....[1]

- (b) The total amount of money that the school collects from pre-school pupils and lower primary school pupils is at least P1 372 000 in the term

Write down an inequality, in terms of x and/or y , to represent this information and show that it reduces to $4x + 7y \geq 1960$

..... [2]

- (c) The total number of pre-school pupils and lower primary school pupils that the school collects tuition fee is not more than 410

Write down an inequality, in terms of x and y , to represent this information

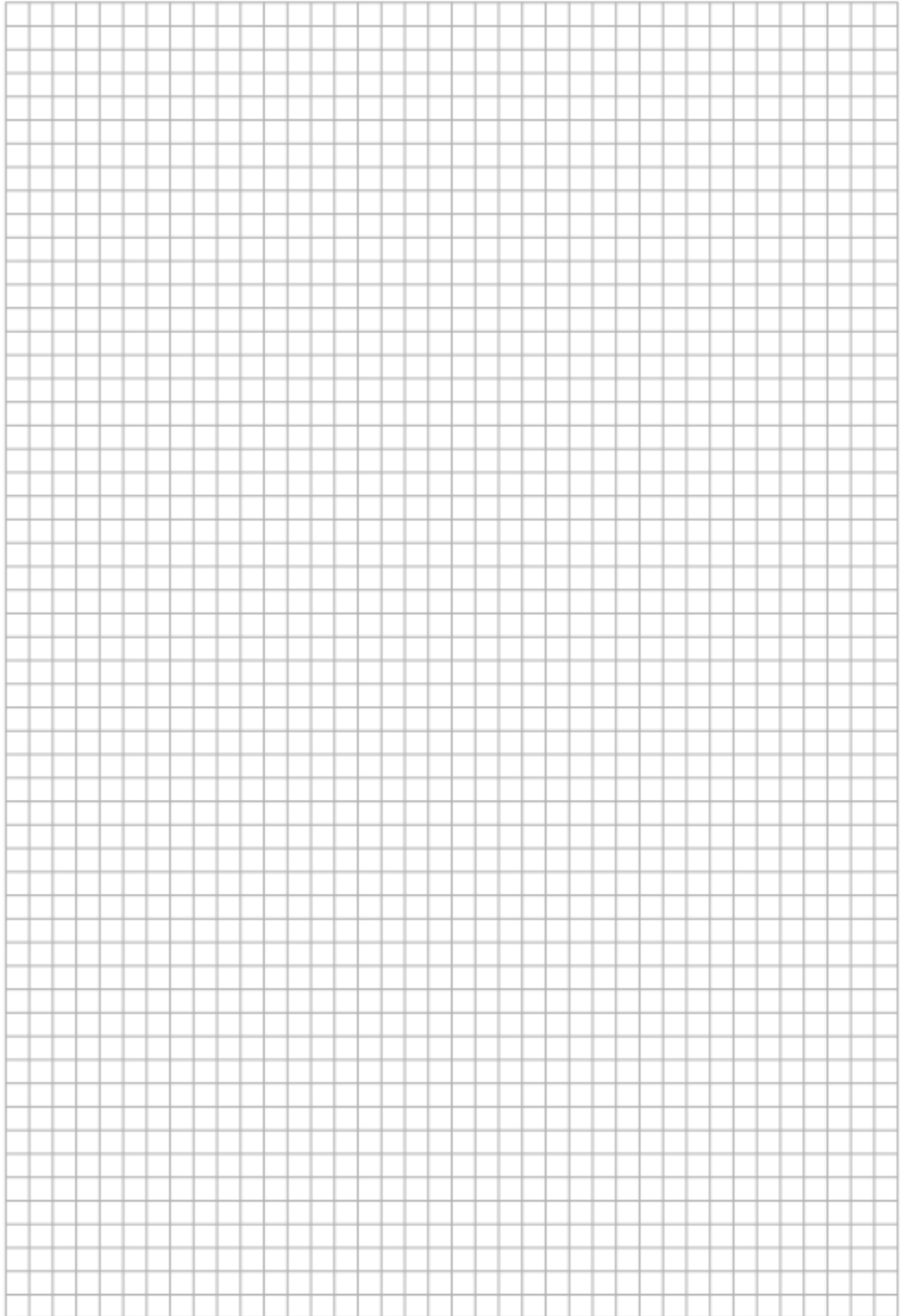
.....[2]

- (d) The school collects tuition fee from at most 240 lower primary school pupils
Write down an inequality to represent this information

.....[1]

- (e) Using a scale of one box to represent 100 units on each axis show, by shading the unwanted region, the set of points that satisfy the inequalities in parts (b) , (c) and (d).

[6]



(f) (ii) Determine the number of pre-school pupils and lower primary schools pupils for which the school would collect the maximum amount of money.

.....[2]

(iii) Calculate the maximum amount of money the school collects

.....[2]

13

The table below shows the number of people who entered a shopping mall at different time intervals during the first 2 hours of opening.

| Time (t minutes) | Frequency |
|---------------------|-----------|
| $0 \leq t < 15$ | 60 |
| $15 \leq t < 30$ | 30 |
| $30 \leq t < 45$ | 75 |
| $45 \leq t < 75$ | 90 |
| $75 \leq t < 120$ | 135 |

Without drawing a cumulative frequency curve, calculate an estimate of the

(i) Median

(ii) 85th percentile

..... [4]

.....[3]