Reading Time: An initial **2 minutes** to view **BOTH** sections

MATHEMATICS METHODS : UNITS 3 & 4, 2023

Test 3 – (10%)

3.1.9, 3.2.5, 3.3.9 to 3.3.16, 4.1.1 to 4.1.5

QZ

Time Allowed 25 minutes	**First Name**	**Surname**	**Marks** 24 marks

Circle your Teacher's Name: Mrs Alvaro, Ms Chua, Mrs Fraser-Jones, Mrs Greenaway, Mr Luzuk, Mrs Murray, Ms Narendranathan, Mr Tanday

Assessment Conditions: ***(N.B. Sufficient working out must be shown to gain full marks)***

- Calculators: Not Allowed
- Formula Sheet: Provided
- Notes: Not Allowed

PART A – CALCULATOR FREE

QUESTION 1 **(3 marks: 1,2)**

Simplify each of the following, writing as a single logarithmic term.

a) $\log a + \log a^{-3} + 2$

b) $\log_6 125 - \log_6 32 - \log_6 0.4$

QUESTION 2 **(6 marks: 1,2,3)**

Let $x = \log_n 6$ and $y = \log_n 12$.

a) Write $2x - y$ as a single logarithmic term.

b) Express the following in terms of x and/or y.

i) $\log_n(0.5)$

ii) $\log_n(12n)$

c) Determine the exact value of n^{3x}.

QUESTION 3 **(4 marks: 2,2)**

Determine the following,

a) $\frac{d}{dx}\left(3\cos\left(4x+\frac{\pi}{3}\right)\right)$

b) $\int \cos(2x)\sin^5(2x)\,dx$

QUESTION 4 **(3 marks)**

Determine the equation of the curve with gradient function, $\frac{dy}{dx} = \sin(\pi x)$ at the point $\left(\frac{1}{2}\ ,\ \pi\right)$.

QUESTION 5 **(2 marks)**

Decibels are a unit of measure of loudness (of sound) and can be calculated using the equation, $D = 7\log\left(\frac{I}{I_{ref}}\right)$, where I is sound intensity, I_{ref} is the reference sound intensity. What is the decibel level of a sound with intensity one thousand times the reference intensity?

QUESTION 6 **(6 marks: 2,4)**

Determine the **exact** value of x in each of the following:

a) $5^{x+1} - 5^x = 30$

b) $\log_2 x = 1 - \log_2(x-1)$

END OF PART A

Reading Time: An initial **2 minutes** to view **BOTH** sections

MATHEMATICS METHODS : UNITS 3 & 4, 2023

Test 3 – (10%)

3.1.9, 3.2.5, 3.3.9 to 3.3.16, 4.1.1 to 4.1.5

QG

Time Allowed	**First Name**	**Surname**	**Marks**
25 minutes			22 marks

Circle your Teacher's Name: Mrs Alvaro, Ms Chua, Mrs Fraser-Jones, Mrs Greenaway, Mr Luzuk, Mrs Murray, Ms Narendranathan, Mr Tanday

Assessment Conditions: ***(N.B. Sufficient working out must be shown to gain full marks)***

- Calculators: Allowed
- Formula Sheet: Provided
- Notes: Not Allowed

PART B – CALCULATOR ALLOWED

QUESTION 7 **(5 marks: 1,1,2,1)**

75% of confectionary produced at the Ladbury's chocolate factory are coated in milk chocolate and the rest are coated in dark chocolate. Let X represent the event that a randomly selected chocolate is coated in dark chocolate.

a) Calculate E(X).

b) Calculate Var(X).

c) If Y = 10X – 2, determine E(Y) and Var(Y).

d) What is the probability that if three chocolates are selected, at least one will be coated in milk chocolate?

QUESTION 8 **(6 marks: 1,2,2,1)**

A new teaching method to improve arithmetic skills is being investigated by our school. A group of 50 students are randomly chosen to take part in a ten week trial of the new method. There is a 60% chance that any one of these students will show an improvement in arithmetic skills after ten weeks if they do not take part in the trial.

Let X denote the number of students out of the 50 who will show an improvement in arithmetic skills after ten weeks if they do not take part in the trial.

a) State the probability distribution of X.

b) Calculate the mean and standard deviation of X.

c) What is the probability that at least half of the students will show an improvement in arithmetic skills after ten weeks if they do not take part in the trial?

d) What is the most likely number of students in a group of 50 to show an improvement after ten weeks if they do not take part in the trial?

QUESTION 9 **(5 marks: 2,3)**

Bank East has established that 65% of all Visa card accounts are paid in full following the first statement being sent to the customer. A sample of 10 Visa card holders is taken. Let the random variable X be the number of people from the sample of 10 who paid their accounts in full after receiving the first statement.

a) What is the probability that after receiving the first statement, all 10 from the sample pay in full, given that at least 8 paid their account in full?

b) A new sample group is to be created such that the probability of having at least one Visa card holder having paid their account in full after the first statement is at least 0.95. Determine the minimum sample size.

QUESTION 10 **(6 marks: 3,3)**

A discrete random variable, X is a Bernoulli distribution as shown.

X	0	1
$P(X = x)$	q	p

a) What value of p would maximise the variance, and what is this maximum variance?

b) Determine p if $SD(X) = \frac{\sqrt{6}}{5}$ and p > q .

END OF PART B