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

MATHEMATICS METHODS : UNITS 3 & 4, 2021

Test 4 – (10%)

4.1.9 – 4.1.14, 4.2, 4.3.1 – 4.3.3

Time Allowed	**First Name**	**Surname**	**Marks**
22 minutes	Overall mean 53%		22 marks

Circle your Teacher's Name:

Mrs Alvaro	Mrs Bestall	Ms Chua
Mr Gibbon	Mrs Greenaway	Mr Luzuk
Mrs Murray	Ms Robinson	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 **[2, 2 – 4 marks]**

Differentiate the following with respect to x.

a) $f(x) = \sin(5x)\ln(x)$

b) $f(x) = \ln\left[\dfrac{(x+2)^3}{x}\right]$

Question 2 **[1, 5 – 6 marks]**

Consider the function $f(x) = x - \ln(x)$.

a) Find the values for which $f(x)$ is defined.

b) Determine the coordinates and the nature of the stationary point of $f(x)$.

Question 3 **[2 marks]**

Find the integral of $\frac{6x^2 - 8}{x^3 - 4x + 1}$.

Question 4 **[2, 1, 1 – 4 marks]**

An unreinforced concrete path is equally likely to crack anywhere along its length. An unreinforced path is 6m long.

a) Construct a probability density graph for the distance of the first crack from the beginning of the path.

b) Find the probability that the first crack is 2.3m from the beginning of the path.

c) Find the probability that the first crack is between 2.25m and 2.35m from the beginning of the path.

Question 5 **[2 marks]**

A continuous random variable X is transformed to the random variable Y according to the equation $Y = 2X + 3$. The mean and standard deviation of X are 27.8 and 5.6 respectively. What are the mean and standard deviation of Y?

Question 6 **[2, 2 – 4 marks]**

For each of the following cases, state whether the sampling method is biased and justify your reasoning.

a) A Year 11 student asks each of the people in his class what kind of mobile they have and how many SMSs they send each week to determine mobile phone use among high school students.

b) A market research company rings 100 phone numbers taken at random from the residential phone directory to ask whether they vacationed in WA, interstate or overseas in the last 3 years as part of a study for the tourism industry of WA.

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

MATHEMATICS METHODS : UNITS 3 & 4, 2021

Test 4 – (10%)

4.1.9 – 4.1.14, 4.2, 4.3.1 – 4.3.3

Time Allowed	**First Name**	**Surname**	**Marks**
28 minutes			27 marks

Circle your Teacher's Name:

Mrs Alvaro Mrs Bestall Ms Chua
Mr Gibbon Mrs Greenaway Mr Luzuk
Mrs Murray Ms Robinson 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 **[1, 2, 2, 2 – 7 marks]**

A continuous random variable X has the probability density function $f(x) = ax(4 - x^2)$ for $0 \le x \le 2$.

a) Find a.

b) Find the mean of X.

c) Find the standard deviation of X.

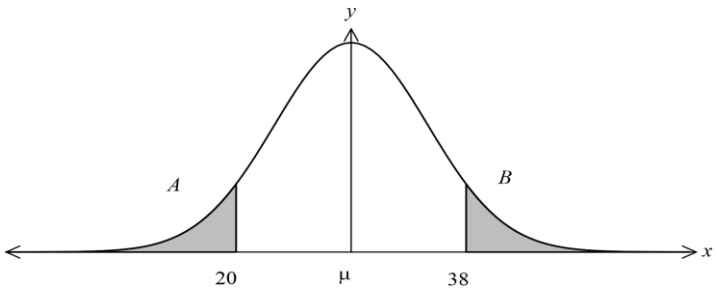
d) Find the median of X.

Question 8 **[3 marks]**

The distribution curve shown corresponds to $X \sim N(\mu, \sigma^2)$.

Area $A =$ Area $B = 0.2$.

Find μ and σ.



Question 9 **[1, 3, 2 – 6 marks]**

Let X be the weight in grams of bags of sugar filled by a machine. Bags less than 500g are considered underweight. Suppose $X \sim N(503, 2^2)$.

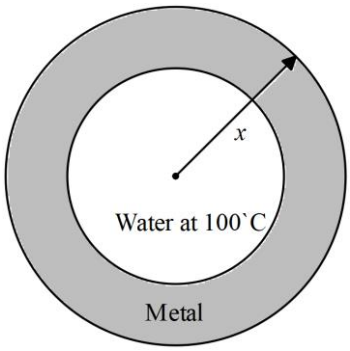
a) What percentage of bags are underweight?

b) Find the probability that the weight of a bag differs from the mean by no more than 5g, given that it weighs less than 505g.

c) If a quality inspector randomly selects 20 bags, what is the probability that 2 or fewer bags are underweight?

Question 10 **[3 marks]**

A metal pipe has a cross-section as shown.



The outer radius is 4cm and the inner radius is 2cm. Within the pipe, the water temperature is maintained at $100°C$.

Within the metal, the temperature drops off from inside to outside according to $\frac{dT}{dx} = -\frac{10}{x}$, where x is the distance from the central axis, $2 \le x \le 4$ and T is in $°C$.

Find the temperature of the outer surface of the pipe.

Question 11 **[4 marks]**

Danielle's class scored an average of 18.8 on an English test with a standard deviation of 5.4. The same group scored an average of 22.3 on a Maths Methods test with a standard deviation of 3.6. Danielle scored 27 on both tests. In which test did she do better? Justify your reasoning.

Question 12 **[4 marks]**

Students learning to use a pottery wheel take an average time of 25 minutes to make a simple pot. 30% of such students complete their pots within 20 minutes. Assuming that the times are normally distributed, what is the probability of a student taking longer than 28 minutes?