2021 VCE Mathematical Methods Trial Examination 2

Kilbaha Education

Quality educational content

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Victorian Certificate of Education
2021

STUDENT NUMBER

									Letter
Figures									
Words									

MATHEMATICAL METHODS
Trial Written Examination 2

Reading time: 15 minutes
Total writing time: 2 hours

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	4	4	60
			Total 80

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, a protractor, set squares, aids for curve sketching, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved computer-based CAS, their full functionality may be used.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question and answer booklet of 30 pages.
- Detachable sheet of miscellaneous formulas at the end of this booklet.
- Answer sheet for multiple-choice questions.

Instructions

- Detach the formula sheet from the end of this book during reading time.
- Write your **student number** in the space provided above on this page.
- Write your **name** and **student number** on your answer sheet for multiple-choice questions, and sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 1; an incorrect answer scores 0.

Mark will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

Let $f:R\to R$, $f(x)=a\left(\cos\left(\frac{\pi x}{b}\right)-1\right)$ where $b\neq 0$ and $a<0$. The period and range of this function respectively are

A. $2b$ and $[0,-2a]$

B. $2b$ and $[2a,0]$

C. $2b$ and $[0,2a]$

D. b and $[2a,0]$

E. b and $[-a,a]$

Question 2

Let $f:[0,3\pi]\to R$, $f(x)=3\sin\left(\frac{x}{3}\right)-3$. The graph of f is transformed by a reflection in the x-axis, followed by a dilation of factor 3 from the y-axis, then a dilation by a factor of 3 from the x-axis. The resulting graph is defined by

A. $g:[0,3\pi]\to R$, $g(x)=9-9\sin\left(\frac{x}{9}\right)$

B. $g:[0,9\pi]\to R$, $g(x)=9-9\sin\left(\frac{x}{9}\right)$

C. $g:[0,\pi]\to R$, $g(x)=9-9\sin(x)$

D. $g:[0,3\pi]\to R$, $g(x)=9-9\sin(x)$

E. $g:[0,\pi]\to R$, $g(x)=1-\sin(x)$

Question 3

A certain curve has its gradient given by $3\sin\left(\frac{x}{3}\right)$. If the curve crosses the x-axis at $x = \frac{\pi}{2}$, then it crosses the y-axis at

A. $\frac{1}{2}\left(\sqrt{3}-2\right)$

B. $\frac{1}{2}\left(2-\sqrt{3}\right)$

C. $\frac{9}{2}\left(\sqrt{3}-2\right)$

D. -9

E. -1

Question 4

A curve has a vertical asymptote with the equation $x = a$ and a horizontal asymptote with the equation $y = b$. Which one of the following could be the equation of the curve?

A. $y = \frac{b}{(x-a)^2}$

B. $y = b + \log_e(x-a)$

C. $y = b - \sqrt{x-a}$

D. $y = b - \frac{1}{(x-a)^2}$

E. $y = b + e^{x-a}$

Question 5

Consider the functions $f : D_f \to R,\ f(x) = \log_e(x+5)$ and $g : D_g \to R,\ g(x) = 4x - x^2$.
For the function $f(g(x))$ to exist, the maximal domain of the function g, that is D_g, is equal to

A. R

B. $(-5, \infty)$

C. $(5, \infty)$

D. $(-\infty, -1)$

E. $(-1, 5)$

Question 6

The function $f:(-\infty,b)\to R$ with the rule $f(x)=kx^2-x^4$, where $k>0$, will have an inverse function provided that

A. $b<-\sqrt{\frac{k}{2}}$

B. $b<k$

C. $b<\sqrt{k}$

D. $b>\sqrt{k}$

E. $b>\sqrt{\frac{k}{2}}$

Question 7

The transformation $T:R^2\to R^2$, which maps the curve with equation $y=2\cos(x)$ onto the curve with equation $y=\sin(2x)$, has the rule

A. $T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}-\frac{1}{2} & 0\\ 0 & -\frac{1}{2}\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}-\frac{\pi}{4}\\0\end{bmatrix}$

B. $T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}-\frac{1}{2} & 0\\ 0 & \frac{1}{2}\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}\frac{\pi}{4}\\0\end{bmatrix}$

C. $T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}-\frac{1}{2} & 0\\ 0 & \frac{1}{2}\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}-\frac{\pi}{2}\\0\end{bmatrix}$

D. $T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}-2 & 0\\ 0 & 2\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}\frac{\pi}{4}\\0\end{bmatrix}$

E. $T\left(\begin{bmatrix}x\\y\end{bmatrix}\right)=\begin{bmatrix}-2 & 0\\ 0 & 2\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix}+\begin{bmatrix}\frac{\pi}{2}\\0\end{bmatrix}$

Question 8

Let $A=\int_a^b f(x)\,dx$, where $b>a>0$, $k>0$ and $f(x)>0$ for $a\le x\le b$.

Which of the following is **false**?

A. $A+k(b-a)=\int_a^b \left(f(x)+k\right)dx$

B. $A=\dfrac{1}{k}\displaystyle\int_{ak}^{bk} f\left(\frac{x}{k}\right)dx$

C. $A=\displaystyle\int_{ak}^{bk} \frac{f(kx)}{k}\,dx$

D. $A=\int_{a-k}^{b-k} f(x+k)\,dx$

E. $A=\int_{a+k}^{b+k} f(x-k)\,dx$

Question 9

A box contains r red marbles and b blue marbles, where $r, b\in Z^+$ and $r>3$ and $b>3$.
Zach draws three marbles from the box without replacement. The probability that exactly two of the marbles are the same colour is

A. $1-\left[\dfrac{b(b-1)(b-2)+r(r-1)(r-2)}{(b+r)(b+r-1)(b+r-2)}\right]$

B. $\dfrac{b(b-1)+r(r-1)}{(b+r)(b+r-1)(b+r-2)}$

C. $\dfrac{b}{b+r}+\dfrac{r}{b+r}+\dfrac{2(b-1)(r-1)}{(b+r)(b+r-1)(b+r-2)}$

D. $\dfrac{3br}{(b+r)(b+r-1)}$

E. $\dfrac{br}{(b+r)(b+r-1)}$

Question 10

Given the two linear simultaneous equations $4y-nx=n^2$ and $ny-mx=n$, then if

A. $n=m$ there is more than one solution.

B. $n=-2$ and $m=-1$ there is an infinite number of solutions.

C. $n=-2$ and $m=1$ there is no solution.

D. $n=2$ and $m=-1$ there is no solution.

E. $n=2$ and $m=1$ there is an infinite number of solutions.

Question 11

Given that $\frac{d}{dx}\left(x^2e^{-kx}\right)=xe^{-kx}\left(2-kx\right)$, then $\int x^2e^{-kx}dx$ is equal to

A. $\frac{1}{k}\int\left(x^2-2x\right)e^{-kx}\,dx+c$

B. $\frac{x^2}{k}e^{-kx}-\frac{2}{k}\int xe^{-kx}\,dx+c$

C. $\frac{2}{k}\int xe^{-kx}\,dx-\frac{x^2}{k}e^{-kx}+c$

D. $\frac{1}{3k}x^3\,e^{-kx}+c$

E. $x^2e^{-kx}\left(\frac{x}{3}-\frac{1}{k}\right)+c$

Question 12

A discrete random variable X has the probability function $\Pr\left(X=k\right)=\frac{e^{-\lambda}\lambda^k}{k!}$, where k is a non-negative integer and $\lambda\in R^+$. The probability that X is less than three, given that X is at least one is equal to

A. $\frac{\lambda^2e^{-\lambda}}{2}$

B. $\frac{\lambda e^{-\lambda}}{2}\left(\lambda+2\right)$

C. $\frac{\lambda e^{-\lambda}\left(\lambda+2\right)}{2\left(1-e^{-\lambda}\right)}$

D. $\frac{\lambda e^{-\lambda}}{2\left(1-e^{-\lambda}\right)}$

E. $1-e^{-\lambda}\left(\lambda+1\right)$

Question 13

Let $\Pr\left(A\right)=a^2$, $\Pr\left(B\right)=b^2$ and $\Pr\left(A\cap B\right)=p^2$ where $0<a<1$, $0<b<1$ and $0<p<1$.
Given that $\left(1-a^2\right)\left(1-b^2\right)=\left(1-a\right)\left(1-b\right)+\left(p-b\right)\left(p+b\right)$, then

A. the events A and B' are mutually exclusive.

B. the events A' and B' are mutually exclusive.

C. the events A and B' are not independent.

D. the events A' and B' are not independent.

E. the events A and B' are independent.

Question 14

Consider the function with rule $f(x)=\dfrac{x-a}{x-1}$, where $a \in R \setminus \{1\}$.

Then the function and its inverse f^{-1}

A. do not intersect.

B. intersect at only one point on the line $y = x$.

C. have three distinct points of intersection.

D. have an infinite number of points of intersection.

E. intersect at only two points $(0,0)$ and $(2,2)$ when $a = 0$.

Question 15

Let $g(x)= f^{-1}(x)$, $f(a)=b$, $f'(a)=c$ and $f'(b)=d$. Then $g'(b)$ is equal to

A. $\dfrac{1}{cd}$

B. $\dfrac{1}{d}$

C. $-c$

D. $-d$

E. $\dfrac{1}{c}$

Question 16

In a large city, 10% of the people are divorced. A random sample of 25 people is selected. For samples of 25 people, $\hat{P}$ is the random variable of the distribution of divorced people. $\Pr\left(\hat{P} < 0.2\right)$ is closest to (Do not use a normal approximation)

A. 0.902

B. 0.967

C. 0.617

D. 0.5

E. 0.421

Question 17

The probability distribution function for the continuous random variable X is given by

$$f(x)=\begin{cases} kx & \text{for } 0 \le x \le a \\ 0 & \text{otherwise} \end{cases}$$

The mean value of the function $f(x)$ over $0 \le x \le a$, where $a > 0$, is equal to 2. Then

A. $k = 8$

B. $k = 4$

C. $k = 2$

D. $k = \frac{1}{2}$

E. there are no values of a or k for this to be true.

Question 18

A certain type of light globe has two types: light or dark. A random sample of 36 such light globes contained x light globes. The upper value of a 95% confidence interval is maximised when x is equal to

A. 9

B. 18

C. 34

D. 35

E. 36

Question 19

A discrete random variable X has the following probability distribution.

X	-2	2
$\Pr(X = x)$	$\log_{81}(a)$	$\log_{81}(b)$

If $E(X) = 1$ then

A. $a = 27$ and $b = 3$

B. $a = 3$ and $b = 27$

C. $a = 9$ and $b = 9$

D. $a = 1$ and $b = 81$

E. $a = 81$ and $b = 1$

Question 20

X has a normal distribution with mean μ and standard deviation σ. The probability that X is greater than b is 3%, and the probability that X is less than c is 10%. Then

A. $\frac{b-\mu}{\sigma}=1.88$ and $\frac{c-\mu}{\sigma}=1.28$

B. $\frac{b-\mu}{\sigma}=1.88$ and $\frac{\mu-c}{\sigma}=1.28$

C. $\frac{b-\mu}{\sigma}=0.52$ and $\frac{c-\mu}{\sigma}=1.28$

D. $\frac{b-\mu}{\sigma}=1.88$ and $\frac{\mu-c}{\sigma}=-2.33$

E. $\frac{b-\mu}{\sigma}=0.52$ and $\frac{\mu-c}{\sigma}=-2.33$

END OF SECTION A

SECTION B

Question 1 (15 marks)

Consider the function $f:R \to R$, $f(x) = x^4 - 6x^2 + bx + c$, where $b, c \in R$.

a. If the graph of f crosses the x-axis at $x = 3$, and has a turning point at $x = -2$, find the values of b and c.

2 marks

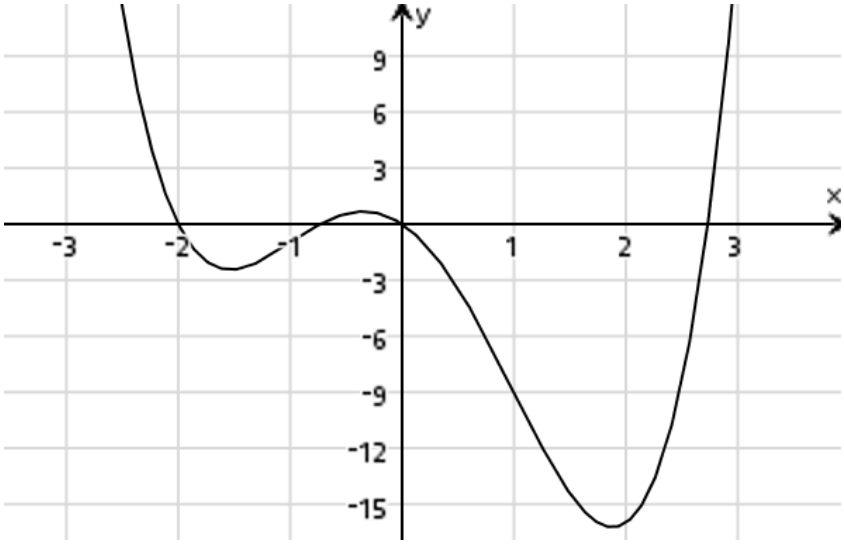
b. For the case when $b = 0$, considering the graph of the function $y = f(x) = x^4 - 6x^2 + c$, complete the following table.

3 marks

$y = f(x) = x^4 - 6x^2 + c$	values of c
crosses the x-axis four times, that is, there are four solutions for $f(x) = 0$.	
crosses the x-axis three times, that is, there are three solutions for $f(x) = 0$.	
crosses the x-axis twice, that is, there are two solutions for $f(x) = 0$.	
does not cross the x-axis, that is, there are no solutions for $f(x) = 0$.	

c. Consider now the case where $b = -4$ and $c = 0$, that is, the function $f(x) = x^4 - 6x^2 - 4x$.

The graph of the function $y = f(x)$ is shown below.



i. Write the rule for f' in terms of *x*, and find the coordinates of the stationary points, giving your answers correct to two decimal places.

1 mark

ii. Find the maximum and minimum values of the gradient function f'.

1 mark

iii. Consider now the points $P(-1, f(-1))$ and $Q(1, f(1))$ on the graph of the function. Show that the line joining the points *P* and *Q* is given by $y = -4x - 5$, and draw this line on the diagram above.

2 marks

iv. The line PQ intersects the graph of $y = f(x)$ at two other points, $S(x_S, f(x_S))$ and $R(x_R, f(x_R))$ where $x_S < x_R$. Find the values of x_S and x_R, and plot the points S and R on the diagram on the previous page.

2 marks

v. Find the distance SP and the distance QR.

2 marks

vi. Let A_1 be the area bounded by the line PQ, the function f and the points S and P.

Let A_2 be the area bounded by the line PQ, the function f and the points P and Q.

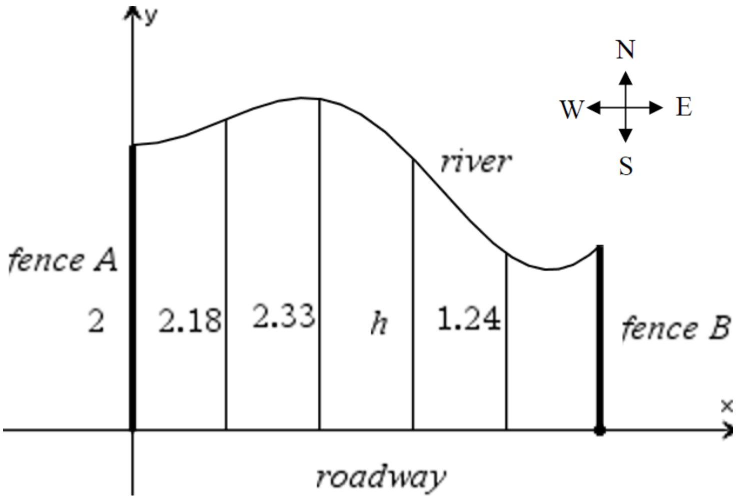
Let A_3 be the area bounded by the line PQ, the function f and the points Q and R.

Write down the three definite integrals for these three areas in terms of x (not $f(x)$) , shade these areas on the diagram on the previous page and evaluate these three areas. What do you observe regarding these three areas?

2 marks

Question 2 (10 marks)

A farmer has a field. One side of his field is on a straight roadway, which runs west to east, along the x-axis, and is one kilometre long. Two fences A and B, are perpendicular to the roadway, running south to north. Fence A runs along the y-axis and has a length of two kilometres. The northern most section of the field is bounded by a river. The x and y-axis are measured in kilometres.



The field can be divided into five equal spaced sections, with the lengths in kilometres of the sections shown in the diagram above. Note that the diagram is not drawn to scale. When the area of the field is approximated by five left endpoint rectangles the area is 1.93 km^2, and when approximated by five right endpoint rectangles the area is 1.79 km^2.

a. Determine the length marked h on the diagram and the length of fence B, giving both answers in kilometres, correct to two decimal places.

1 mark

The farmer now decides he can model the river by the function

$f:[0,1] \to R\ ,\ f(x) = x\sin\left(\dfrac{7\pi x}{4}\right) + 2$

b. Using this model, find the length of the fence B.

1 mark

c. Write down the function $f'(x)$, and find the coordinates of the points on the river that are closest and furthest from the roadway. Give your answers in kilometres, correct to three decimal places.

2 marks

d. The farmer is at a point with coordinates $(0.3, 0.4)$ and needs to go to the river to collect some water. Find the closest distance from this point to the river, giving your answer in kilometres correct to four decimal places.

3 marks

e. When the field area was approximated using five left endpoint rectangles, $L = 1.93\ \text{km}^2$ and when the field area was approximated using five right endpoint rectangles, $R = 1.79\ \text{km}^2$.

Does the average of these, that is $\frac{1}{2}(L+R)$ over or under estimate the area of the field when modelled by the function f?

1 mark

f. The farmer now decides to divide his field into two sections, each of equal area, by one fence, which runs parallel to fences *A* and *B*. Determine the length of this required fence, from the roadway to the river. Give your answer in kilometres, correct to four decimal places.

2 marks

Question 3 (18 marks)

The weights of tennis balls are normally distributed with a mean of 57 grams and a standard deviation of 0.937 grams.

a. **i.** Find the probability, correct to four decimal places, that a randomly selected tennis ball has a mass of less than 56 grams.

1 mark

ii. Find the probability, correct to four decimal places, that in a container of three tennis balls, at least one has a mass of less than 56 grams.

1 mark

b. In a random sample of n tennis balls, the probability that two or three tennis balls, each have a mass of less than 56 grams is 50% or more. Find the possible value(s) of n, correct to the nearest integers.

2 marks

For random samples of 49 tennis balls, $\hat{P}$ represents the random variable of tennis balls having a mass of less than 56 grams.

c. **i.** Find the expected value and standard deviation of $\hat{P}$, giving your answers correct to three decimal places.

1 mark

ii. Find the probability that the sample proportion of tennis balls having a mass of less than 56 grams lies within two standard deviations of the mean. Give your answer correct to three decimal places. Do not use a normal approximation.

2 marks

d. A *C*% confidence interval for the proportion of another random sample of 49 tennis balls having a mass of less than 56 grams, was calculated to be $(0.0523, 0.2334)$.

Find the value of *C*, giving your answer to the nearest integer, (as *C* is the coefficient of the %).

2 marks

It has been found that the duration T for a final of a tennis match, in hours, is given by the probability density function

$$f(t)=\begin{cases} a\sin\left(\dfrac{\pi t}{4}\right) & 0\le t\le 2 \\ \dfrac{a(4-t)}{2} & 2<t\le 4 \\ 0 & \text{elsewhere} \end{cases}$$

e. **Show** that $a=\dfrac{\pi}{\pi+4}$.

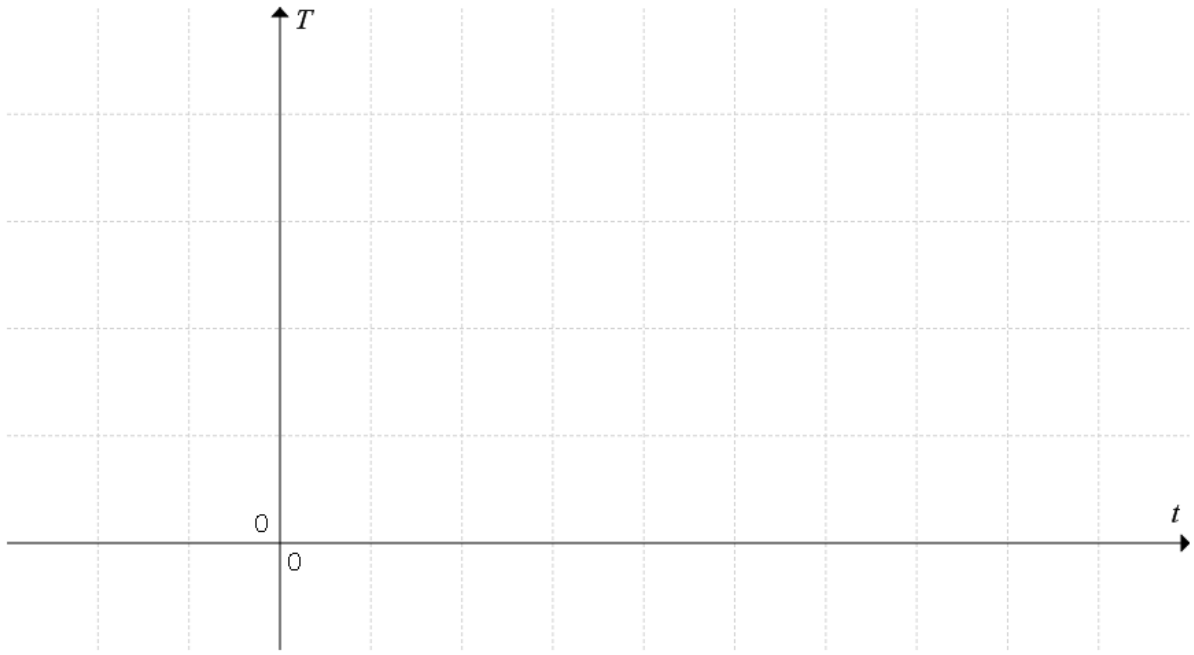
2 marks

f. Find the probability that a final of a tennis match went for longer than 180 minutes, given that the match went for longer than one hour.

2 marks

g. Sketch the graph of $T(t)$ on the axes below, clearly labelling the scales and significant points.

2 marks



h. Find $\mathrm{E}(T)$ in hours and $\operatorname{var}(T)$, in hours^2, giving your answers correct to four decimal places.

2 marks

i. Find the median time for a final of a tennis match. Give your answer correct to the nearest minute.

1 mark

Question 4 (17 marks)

Consider the function $f:\left(\frac{5}{2},\infty\right)\to R$, $f(x)=\log_3(2x-5)-5$.

a. The transformation $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right)=\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}+\begin{bmatrix} p \\ q \end{bmatrix}$ maps the graph of $y=\log_e(x)$ onto the graph of f . State the values of *a*, *b*, *p* and *q*.

2 marks

b. The equation of the tangent to the graph of f at the point where $x=u$ can be written in the form $y=\frac{nx}{(2u-5)}+\log_3(2u-5)-5-\frac{nu}{2u-5}$, where $n=\log_3(m)$. Find the value of *m*.

2 marks

Consider now the function $g:\left(\frac{k}{2},b\right]\to R$, $g(x)=\log_3(2x-k)-k$ where $b>\frac{k}{2}>0$.

c. The slope of the tangent to the graph of g at the point where $x=v$ and $v>0$, makes an angle of 45^0 with the positive end of the x-axis. Express v in terms of k.

1 mark

d. The tangent to the graph of g at the point where $x=3$ passes through the origin. Determine the angle that this tangent makes with the positive direction of the x-axis. Give your answer in degrees, correct to one decimal place.

2 marks

e. Find the inverse function, g^{-1}, stating its domain and range.

2 marks

f. Find $g^{-1}\left(\log_3(2b-k)-k\right)$.

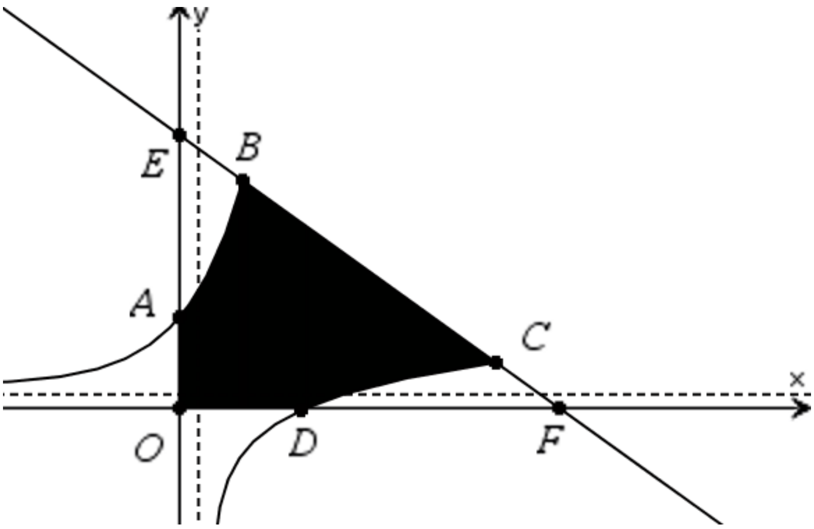
1 mark

g. The tangent to the graph of g^{-1} at the point where $x=1$ passes through the origin.

Find the possible angles(s) to the nearest degree that this tangent makes with the positive direction of the *x*-axis. Give your answer in degrees, correct to one decimal place.

3 marks

h. The diagram below shows parts of the graphs of g and g^{-1} and the line $y = c - x$, which passes through the endpoints of both functions. Write down the coordinates of the points, A, B, C, D, E and F, and show that $c = b - k + \log_3(2b-k)$, assuming $b > \frac{1}{2}\left(3^k + k\right)$.



2 marks

i. The shaded area can be expressed as $R - 2\int_{\frac{1}{2}\left(3^k+k\right)}^{b} g(x)\,dx$.

Express R in terms of b and c.

2 marks

END OF SECTION B

EXTRA WORKING SPACE

End of question and answer book for the
2021 Kilbaha VCE Mathematical Methods Trial Examination 2

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MATHEMATICAL METHODS

Written examination 2

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time. This formula sheet is provided for your reference.

Mathematical Methods formulas

Mensuration

area of a trapezium	$\frac{1}{2}(a+b)h$	volume of a pyramid	$\frac{1}{3}Ah$
curved surface area of a cylinder	$2\pi rh$	volume of a sphere	$\frac{4}{3}\pi r^3$
volume of a cylinder	$\pi r^2 h$	area of triangle	$\frac{1}{2}bc\sin(A)$
volume of a cone	$\frac{1}{3}\pi r^2 h$		

Calculus

$\frac{d}{dx}\left(x^n\right)=nx^{n-1}$		$\int x^n dx=\frac{1}{n+1}x^{n+1}+c\ ,\ n\neq -1$	
$\frac{d}{dx}\left((ax+b)^n\right)=na(ax+b)^{n-1}$		$\int (ax+b)^n\,dx=\frac{1}{a(n+1)}(ax+b)^{n+1}+c\ ,\ n\neq -1$	
$\frac{d}{dx}\left(e^{ax}\right)=ae^{ax}$		$\int e^{ax}dx=\frac{1}{a}e^{ax}+c$	
$\frac{d}{dx}\left(\log_e(x)\right)=\frac{1}{x}$		$\int \frac{1}{x}dx=\log_e(x)+c,\ x>0$	
$\frac{d}{dx}\left(\sin(ax)\right)=a\cos(ax)$		$\int \sin(ax)\,dx=-\frac{1}{a}\cos(ax)+c$	
$\frac{d}{dx}\left(\cos(ax)\right)=-a\sin(ax)$		$\int \cos(ax)\,dx=\frac{1}{a}\sin(ax)+c$	
$\frac{d}{dx}\left(\tan(ax)\right)=\frac{a}{\cos^2(ax)}=a\sec^2(ax)$			
product rule	$\frac{d}{dx}(uv)=u\frac{dv}{dx}+v\frac{du}{dx}$	quotient rule	$\frac{d}{dx}\left(\frac{u}{v}\right)=\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$
chain rule	$\frac{dy}{dx}=\frac{dy}{du}\frac{du}{dx}$		

Probability

$\Pr(A) = 1 - \Pr(A')$		$\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$	
$\Pr(A \mid B) = \dfrac{\Pr(A \cap B)}{\Pr(B)}$			
mean	$\mu = E(X)$	variance	$\operatorname{var}(X) = \sigma^2 = E\left((X-\mu)^2\right) = E(X^2) - \mu^2$

Probability distribution		Mean	Variance
discrete	$\Pr(X = x) = p(x)$	$\mu = \sum x\, p(x)$	$\sigma^2 = \sum (x-\mu)^2\, p(x)$
continuous	$\Pr(a < X < b) = \int_a^b f(x)\,dx$	$\mu = \int_{-\infty}^{\infty} x\, f(x)\,dx$	$\sigma^2 = \int_{-\infty}^{\infty} (x-\mu)^2\, f(x)\,dx$

Sample proportions

$\hat{P} = \dfrac{X}{n}$		mean	$E(\hat{P}) = p$
standard deviation	$\operatorname{sd}(\hat{P}) = \sqrt{\dfrac{p(1-p)}{n}}$	approximate confidence interval	$\left(\hat{p} - z\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}\,,\ \hat{p} + z\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}\right)$

END OF FORMULA SHEET

ANSWER SHEET

STUDENT NUMBER

										Letter
Figures										
Words										

SIGNATURE ______________________________

SECTION A

1	**A**	**B**	**C**	**D**	**E**
2	**A**	**B**	**C**	**D**	**E**
3	**A**	**B**	**C**	**D**	**E**
4	**A**	**B**	**C**	**D**	**E**
5	**A**	**B**	**C**	**D**	**E**
6	**A**	**B**	**C**	**D**	**E**
7	**A**	**B**	**C**	**D**	**E**
8	**A**	**B**	**C**	**D**	**E**
9	**A**	**B**	**C**	**D**	**E**
10	**A**	**B**	**C**	**D**	**E**
11	**A**	**B**	**C**	**D**	**E**
12	**A**	**B**	**C**	**D**	**E**
13	**A**	**B**	**C**	**D**	**E**
14	**A**	**B**	**C**	**D**	**E**
15	**A**	**B**	**C**	**D**	**E**
16	**A**	**B**	**C**	**D**	**E**
17	**A**	**B**	**C**	**D**	**E**
18	**A**	**B**	**C**	**D**	**E**
19	**A**	**B**	**C**	**D**	**E**
20	**A**	**B**	**C**	**D**	**E**

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