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SPECIALIST MATHEMATICS

TRIAL EXAMINATION 2

2010

Reading Time: 15 minutes
Writing time: 2 hours

Instructions to students

This exam consists of Section 1 and Section 2.
Section 1 consists of 22 multiple-choice questions and should be answered on the detachable answer sheet on page 32 of this exam. This section of the paper is worth 22 marks.
Section 2 consists of 5 extended-answer questions, all of which should be answered in the spaces provided. Section 2 begins on page 14 of this exam. This section of the paper is worth 58 marks.
There is a total of 80 marks available.
Where more than one mark is allocated to a question, appropriate working must be shown.
Where an exact value is required to a question a decimal approximation will not be accepted.
Unless otherwise stated, diagrams in this exam are not drawn to scale.
The acceleration due to gravity should be taken to have magnitude g m/s^2 where $g = 9.8$
Students may bring one bound reference into the exam.
Students may bring an approved graphics or CAS calculator into the exam.
Formula sheets can be found on pages 29-31 of this exam.

SECTION 1

Question 1

The graph of $y = \dfrac{1}{x^2 - x - 2}$ has

A. two asymptotes and one local minimum
B. two asymptotes and two local maximum
C. two asymptotes and one local maximum
D. three asymptotes and one local maximum
E. three asymptotes and two local minimum

Question 2

The number of points which are common to the graphs of

$$\frac{x^2}{4} + \frac{y^2}{9} = 1 \quad \text{and} \quad \frac{(x+1)^2}{9} - \frac{y^2}{9} = 1$$

is

A. zero
B. one
C. two
D. three
E. four

Question 3

The function *f* with rule $f(x) = a\tan^{-1}(x - b) + c$ has its maximal domain and *a*, *b* and *c* are positive constants.
The graph of $y = f(x)$ has no *x*-intercepts if

A. $c < \dfrac{a\pi}{4}$

B. $c = \dfrac{a\pi}{4}$ only

C. $c < \dfrac{a\pi}{2}$

D. $c = \dfrac{a\pi}{2}$ only

E. $c \geq \dfrac{a\pi}{2}$

Question 4

If $\cot(x) = -\sqrt{2}$ and $\frac{3\pi}{2} \le x \le 2\pi$, then $\sin(x)$ is equal to

A. $-\frac{1}{\sqrt{3}}$

B. $\frac{1}{\sqrt{3}}$

C. $-\sqrt{3}$

D. -2

E. $\frac{\sqrt{3}}{2}$

Question 5

If $z_1 = 1 + \sqrt{3}\,i$ and $z_2 = 1 + i$ then $\frac{z_1}{z_2}$ is equal to

A. $\frac{1}{\sqrt{2}}\text{cis}\left(-\frac{\pi}{12}\right)$

B. $\sqrt{2}\text{cis}\left(\frac{\pi}{12}\right)$

C. $\sqrt{2}\text{cis}\left(\frac{3\pi}{4}\right)$

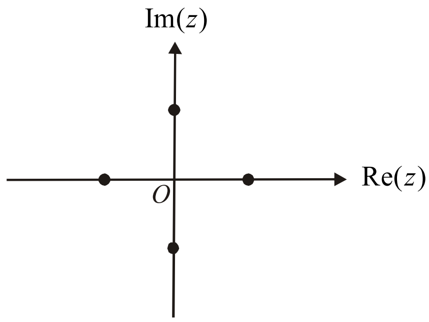
D. $\sqrt{2}\text{cis}\left(\frac{4\pi}{3}\right)$

E. $2\sqrt{2}\text{cis}\left(\frac{\pi}{12}\right)$

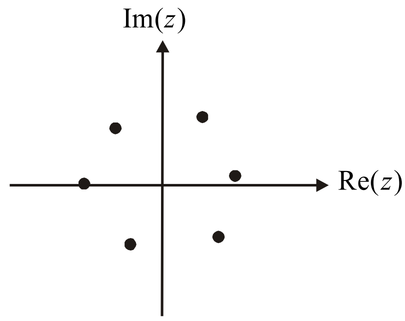
Question 6

Which one of the following Argand diagrams could show the roots of the equation $z^6 = a,\ a \in C$?

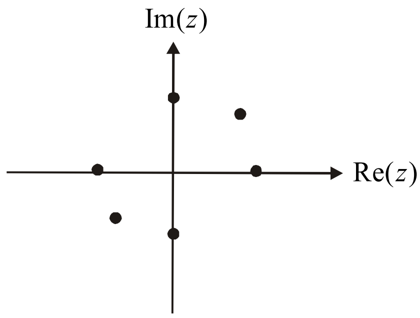
A.



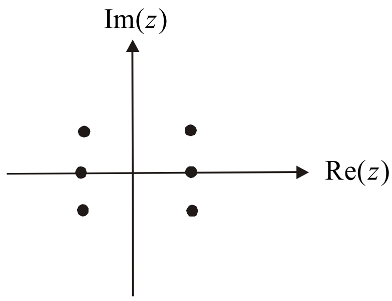
B.



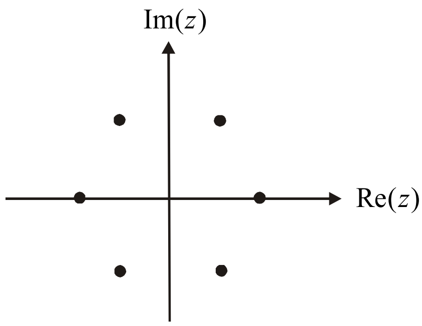
C.



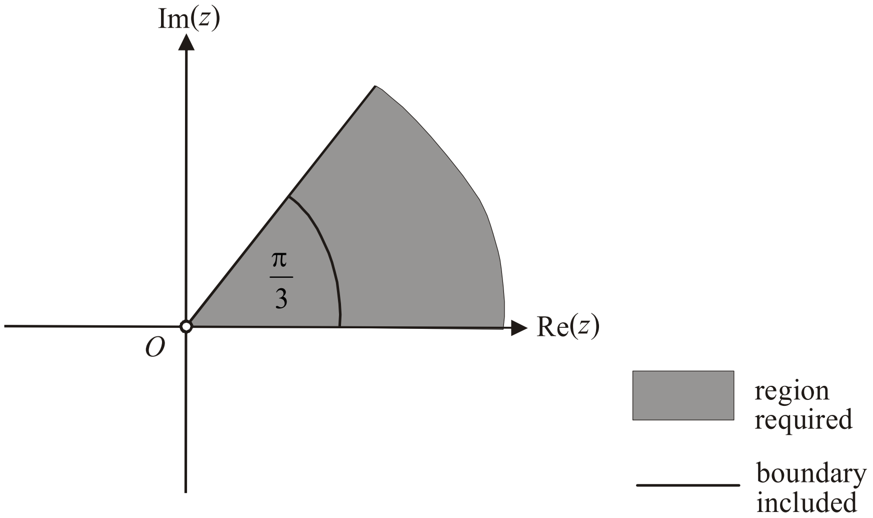
D.



E.



Question 7



The shaded region on the Argand diagram above can be described by

A. $\left\{z : \text{Arg}(z) \le \dfrac{\pi}{3}\right\}$

B. $\{z : \text{Arg}(z) \ge 0\}$

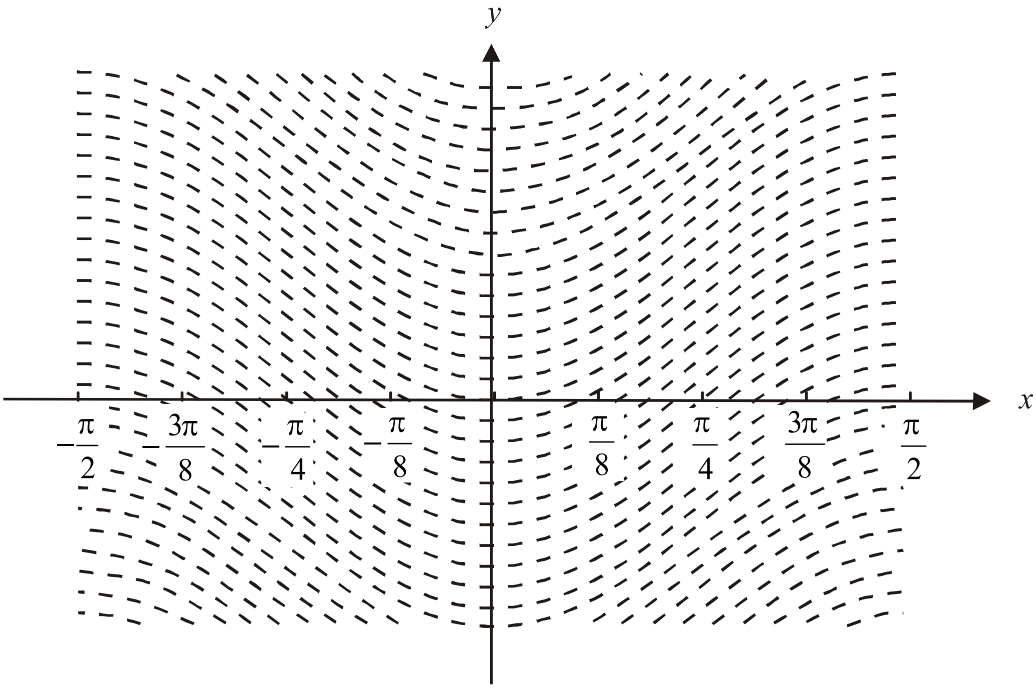
C. $\left\{z : \text{Arg}(z) = \dfrac{\pi}{3}\right\}$

D. $\left\{z : \text{Arg}\left(z - \dfrac{\pi}{3}\right) \le 1\right\}$

E. $\left\{z : 0 \le \text{Arg}(z) \le \dfrac{\pi}{3}\right\}$

Question 8

The direction (slope) field for a differential equation is shown below.



The equation of the differential equation could be

A. $\frac{dy}{dx} = -\sin(2x)$

B. $\frac{dy}{dx} = -\cos(2x)$

C. $\frac{dy}{dx} = \sin(2x)$

D. $\frac{dy}{dx} = \cos(2x)$

E. $\frac{dy}{dx} = \sin\left(\frac{x}{2}\right)$

Question 9

Using an appropriate substitution, $\int_0^{\frac{\pi}{2}} \sin^2(x)\cos^3(x)dx$ can be expressed as

A. $\int_0^{\frac{\pi}{2}} (u^2 - u^4)du$

B. $\int_0^{\frac{\pi}{2}} (u^4 - u^2)du$

C. $\int_0^{1} (u^2 - u^4)du$

D. $\int_{-1}^{0} (u^4 - u^2)du$

E. $\int_0^{1} (u^4 - u^2)du$

Question 10

The area of the region enclosed by the graph of $y = \log_e\left(\frac{x-2}{5}\right)$, the x-axis and the lines with equations $x = 6$ and $x = 9$, expressed in square units, is closest to

A. 0.25
B. 0.41
C. 0.46
D. 0.56
E. 0.63

Question 11

The temperature inside a café is 25°C. A coffee is made in the café and sits on the counter. The initial temperature of the coffee is 62°C. The rate at which the temperature of the coffee drops is proportional to the excess of its temperature over its surrounding air temperature. Let T be the temperature of the coffee at time t minutes after it is placed on the counter. If k is a positive constant, a differential equation relating T and t is

A. $\dfrac{dT}{dt} = -kT - 25 \quad T(0) = 62$

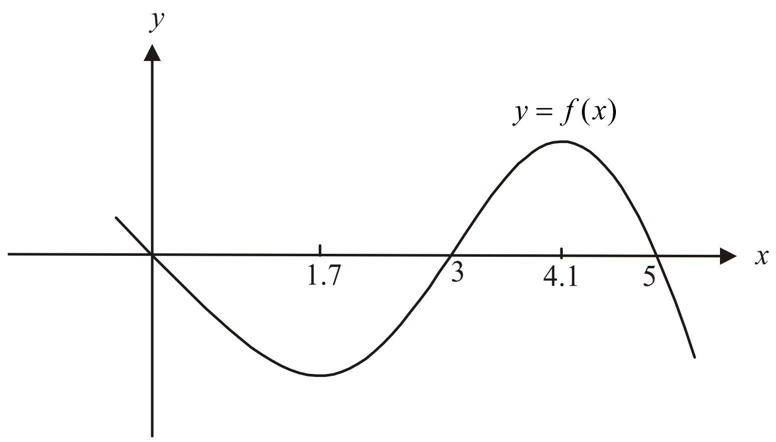
B. $\dfrac{dT}{dt} = kT - 62 \qquad T(0) = 25$

C. $\dfrac{dT}{dt} = k(T - 25) \qquad T(0) = 62$

D. $\dfrac{dT}{dt} = -k(T - 25) \qquad T(0) = 62$

E. $\dfrac{dT}{dt} = -k(T - 62) \qquad T(0) = 25$

Question 12

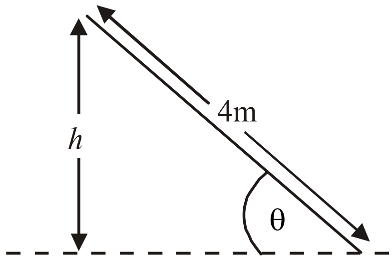


The graph of the function with the rule $y = f(x)$ is shown above.
The antiderivative function has the rule $y = F(x)$. For the graph of $y = F(x)$, it is true to say that it

A. has no points of inflection
B. has no stationary points of inflection
C. has no stationary points
D. has two stationary points
E. has one local maximum and one local minimum

Question 13

A boom gate of length 4 metres makes an angle of θ radians with the horizontal as it is being raised. The height in metres of the end of the boom gate above its horizontal resting position is *h*.



The boom gate is being raised at the rate of 0.05 radians/second. When $\theta = \frac{\pi}{3}$, the rate at which *h* is increasing , in m/sec, is

A. $\frac{1}{20}$

B. $\frac{1}{10}$

C. $\frac{1}{5}$

D. $\frac{\sqrt{2}}{10}$

E. $\frac{\sqrt{3}}{10}$

Question 14

The acceleration of a particle at time *t* seconds is given by $\underset{\sim}{a}(t) = 2\underset{\sim}{i} + 4t\underset{\sim}{j} - \sqrt{t}\underset{\sim}{k}$.

At $t = 0$ its velocity is $\underset{\sim}{v}(t) = \underset{\sim}{i} - \underset{\sim}{j}$.

The velocity of the particle at $t = 1$ is given by

A. $\underset{\sim}{i} + 3\underset{\sim}{j} - \frac{2}{3}\underset{\sim}{k}$

B. $2\underset{\sim}{i} + 2\underset{\sim}{j} - \frac{2}{3}\underset{\sim}{k}$

C. $2\underset{\sim}{i} + 2\underset{\sim}{j} - \frac{1}{2}\underset{\sim}{k}$

D. $3\underset{\sim}{i} + \underset{\sim}{j} - \frac{2}{3}\underset{\sim}{k}$

E. $3\underset{\sim}{i} + \underset{\sim}{j} - \frac{1}{2}\underset{\sim}{k}$

Question 15

Let $\underset{\sim}{u} = \underset{\sim}{i} - 2\underset{\sim}{j} - 3\underset{\sim}{k}$ and $\underset{\sim}{v} = 2\underset{\sim}{i} + \underset{\sim}{j} - \underset{\sim}{k}$. The vector resolute of $\underset{\sim}{u}$ perpendicular to $\underset{\sim}{v}$ is

A. $-\frac{5}{2}(\underset{\sim}{j} + \underset{\sim}{k})$

B. $-5(\underset{\sim}{i} + \underset{\sim}{j})$

C. $-2\underset{\sim}{i} - \frac{5}{2}\underset{\sim}{j} - \frac{5}{2}\underset{\sim}{k}$

D. $\underset{\sim}{i} + \frac{1}{2}\underset{\sim}{j} - \frac{1}{2}\underset{\sim}{k}$

E. $2\underset{\sim}{i} + \frac{1}{2}\underset{\sim}{j} + \frac{1}{2}\underset{\sim}{k}$

Question 16

The vectors $\underset{\sim}{a} = \underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k}$, $\underset{\sim}{b} = -\underset{\sim}{i} + 2\underset{\sim}{j} - 2\underset{\sim}{k}$ and $\underset{\sim}{c} = \underset{\sim}{i} + m\underset{\sim}{k}$ are linearly dependent where m is a real constant.

The value of m is

A. $-\frac{1}{3}$

B. 0

C. $\frac{2}{3}$

D. 1

E. 2

Question 17

A vector has magnitude 3 and is perpendicular to $\underset{\sim}{i} - 2\underset{\sim}{j} + \underset{\sim}{k}$.

The vector could be

A. $\frac{1}{\sqrt{3}}(\underset{\sim}{i} + \underset{\sim}{j} + \underset{\sim}{k})$

B. $\sqrt{3}(\underset{\sim}{i} + \underset{\sim}{j} + \underset{\sim}{k})$

C. $8(\underset{\sim}{i} + \underset{\sim}{j} + \underset{\sim}{k})$

D. $3(3\underset{\sim}{i} + 3\underset{\sim}{j} + \underset{\sim}{k})$

E. $\sqrt{19}(3\underset{\sim}{i} + 3\underset{\sim}{j} + \underset{\sim}{k})$

Question 18

A force acts on a particle at an angle of 120° measured clockwise from the positive direction of the vector $\underset{\sim}{i}$.

The magnitude of the force is expressed in newtons. The force could be represented by the vector

A. $-\underset{\sim}{i}-\sqrt{3}\,\underset{\sim}{j}$

B. $-\underset{\sim}{i}+\sqrt{3}\,\underset{\sim}{j}$

C. $-\sqrt{3}\,\underset{\sim}{i}-\underset{\sim}{j}$

D. $-\sqrt{3}\,\underset{\sim}{i}-\sqrt{3}\,\underset{\sim}{j}$

E. $-\sqrt{3}\,\underset{\sim}{i}+\sqrt{3}\,\underset{\sim}{j}$

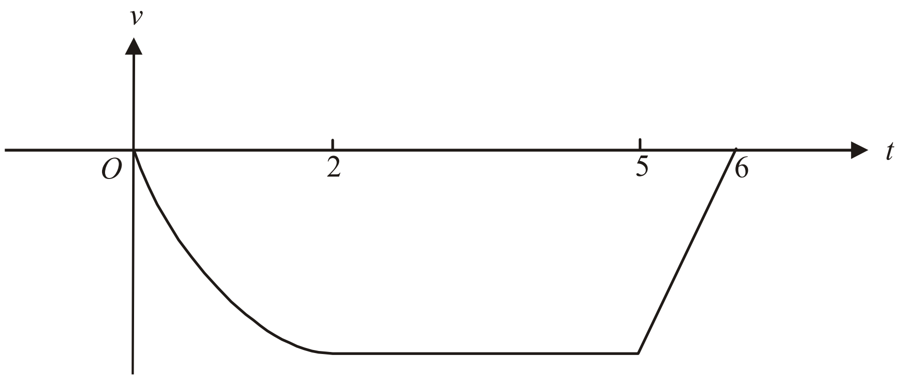
Question 19

An object is moving in a straight line and its momentum is 20kg ms^{-1}.
For the next 10 seconds, the object accelerates constantly until it is travelling at 20ms^{-1} and its momentum is 80kg ms^{-1}.
The distance, in metres, covered by the object during this 10 seconds is

A. 60
B. 75
C. 100
D. 125
E. 180

Question 20

The following graph shows a velocity-time graph for a bicycle and its rider travelling along a straight road.



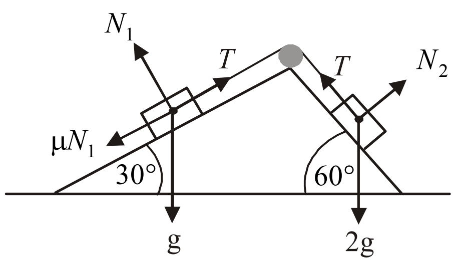
It is true to say that the bicycle and its rider

A. finished at the same point where they started.
B. travelled at a variable speed for the entire trip.
C. travelled in the same direction for the entire trip.
D. travelled at just three different speeds during the trip.
E. were travelling at the slowest speed between $t = 2$ and $t = 5$

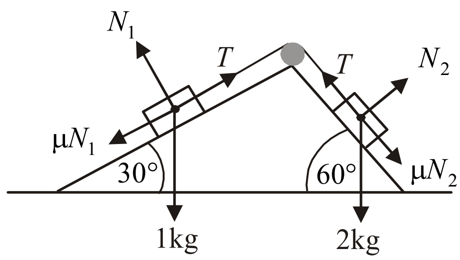
Question 21

A 2kg mass sits on a rough surface inclined at an angle of 60° to the horizontal and is connected to a 1kg mass by a light inextensible string. This 1kg mass sits on a rough surface inclined at an angle of 30° to the horizontal. The coefficient of friction between each mass and the surface it is on is μ. The string passes over a smooth pulley, and the tension in the string is T.
Which one of the following diagrams could show the forces acting on each of the masses?

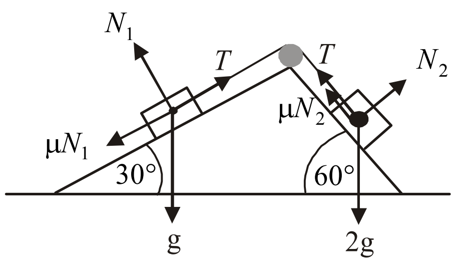
A.



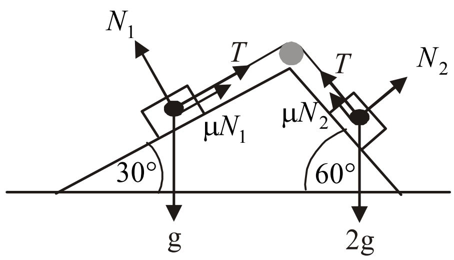
B.



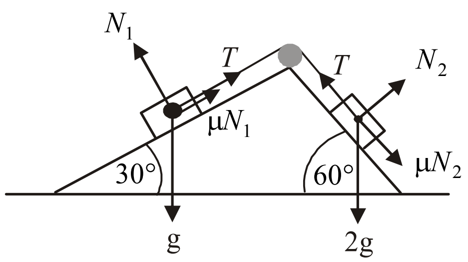
C.



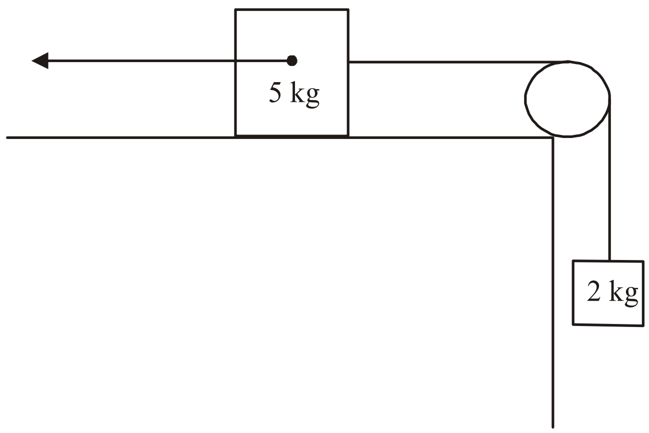
D.



E.



Question 22



A mass of 5kg sits on a rough horizontal bench top and is connected to a 2kg mass by a light, horizontal, inextensible string which passes over a smooth pulley as shown in the diagram above.
The 5kg mass is moved to the left by a horizontal force of 50 newton. The coefficient of friction between the 5kg mass and the bench top is 0.2.
The equation of motion of the 5kg mass is

A. $50-3g=3a$
B. $50-0.8g=5a$
C. $50-3g=5a$
D. $50-3g=7a$
E. $50+g=7a$

SECTION 2

Question 1

Consider the function *f* with rule $f(x) = \frac{30}{\pi}\text{arsin}\left(\frac{x}{2}\right)$. The function *f* has its maximal domain.

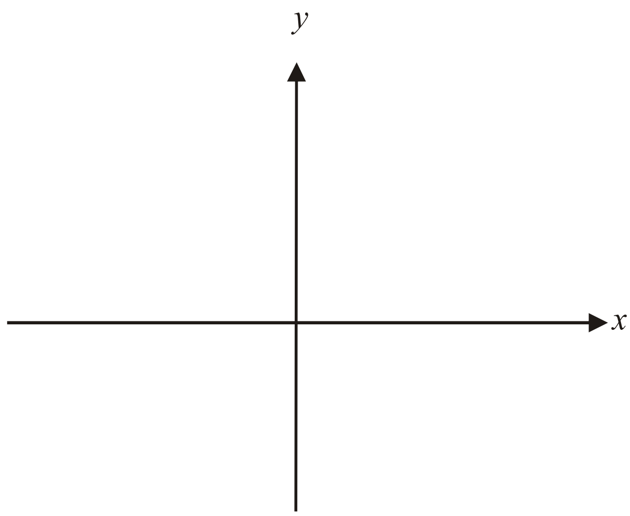
a. For the function *f*, write down

i. the domain.

ii. the range.

$1 + 1 = 2$ marks

b. Sketch the graph of $y = f(x)$ on the set of axes below.



1 mark

c. Show that a point of inflection occurs on the graph of $y = f(x)$ at the point where $x = 0$.

2 marks

An ice cream manufacturer produces "Frojoes" which are made of frozen fruit juice contained in sealed plastic.
The shape of a Frojoe is obtained by rotating the graph of the function g where

$$g:[0,2] \to R,\ g(x) = \frac{30}{\pi}\text{arsin}\left(\frac{x}{2}\right)$$

about the y-axis to form a solid of revolution. The unit of length is the centimetre.

d. Show that the volume V, in cm^3, of a Frojoe is given by $V = 4\pi\int_0^{15} \sin^2\left(\frac{\pi y}{30}\right)dy$

2 marks

e. An alternative expression for V is given by $V = a\pi\int_0^{15}(b - \cos(cy))dy$.

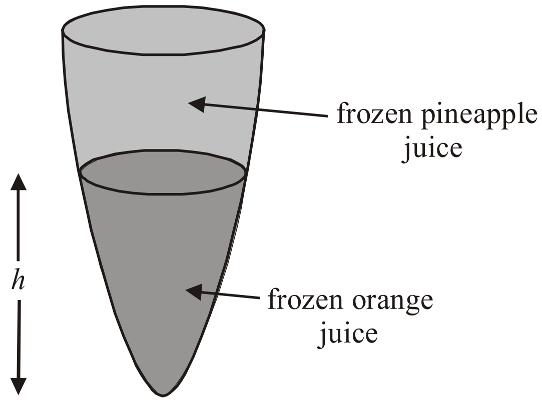
Find the values of a, b and c.

1 mark

f. Find the volume, in cm^3, of a Frojoe. Express your answer as an exact value.

1 mark

Half the volume of a Frojoe is made up of frozen orange juice and the other half is made up of frozen pineapple juice as shown in the diagram below.



g. Find the height of the frozen orange juice, h, in cm correct to 2 decimal places.

2 marks
Total 11 marks

Question 2

A boat is observed from a surf life saving club.
At time t hours after it is first spotted, its position vector is given by

$$\underset{\sim}{r}(t) = \sec\left(\frac{\pi t}{12}\right)\underset{\sim}{i} + 2\tan\left(\frac{\pi t}{12}\right)\underset{\sim}{j}, \quad t \in [0,4]$$

where the origin O represents the position of the surf life saving club.

The $\underset{\sim}{i}$ unit vector represents distances in the easterly direction for positive values of $\underset{\sim}{i}$ and the $\underset{\sim}{j}$ unit vector represents distances in the northerly direction for positive values of $\underset{\sim}{j}$.
After $t = 4$, the boat can no longer be observed.

The displacement components are measured in kilometres.

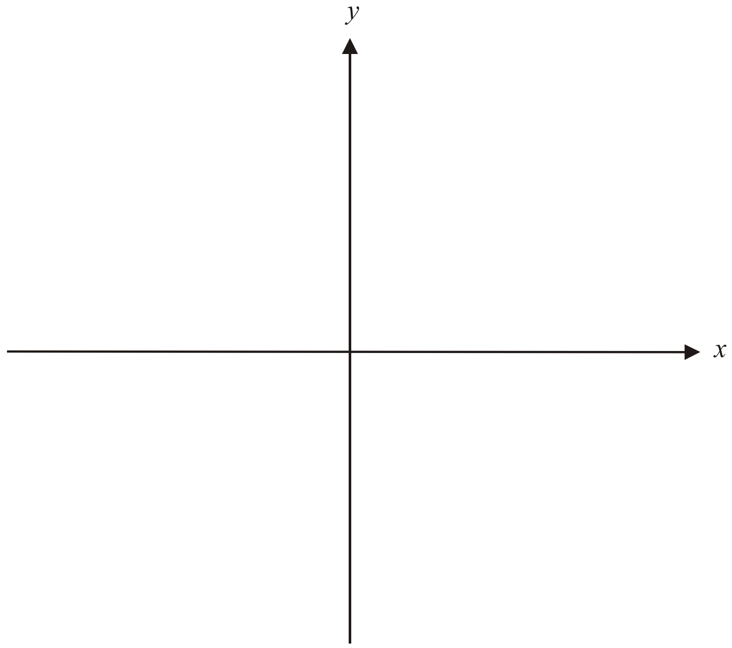
a. Describe the position of the boat in relation to the surf life saving club when the boat is first spotted.

2 marks

b. Show that the Cartesian equation of the path of the boat is given by $x^2 - \frac{y^2}{4} = 1$

2 marks

c. Sketch the path of the boat on the set of axes below. Indicate clearly the coordinates of any endpoints.



2 marks

d. How long does it take for the boat to be 2km north of the surf life saving club?

1 mark

e. Find the exact speed of the boat when $t = 2$.

3 marks

f. When $t = 2$, the boat is moving in the direction θ° to the east of due north.
Find the value of the angle θ in degrees, correct to 2 decimal places.

2 marks
Total 12 marks

Question 3

Consider the function *f* with rule $f(x)=\dfrac{x^2+x-1}{\sqrt{1-x}}$ over its maximal domain.

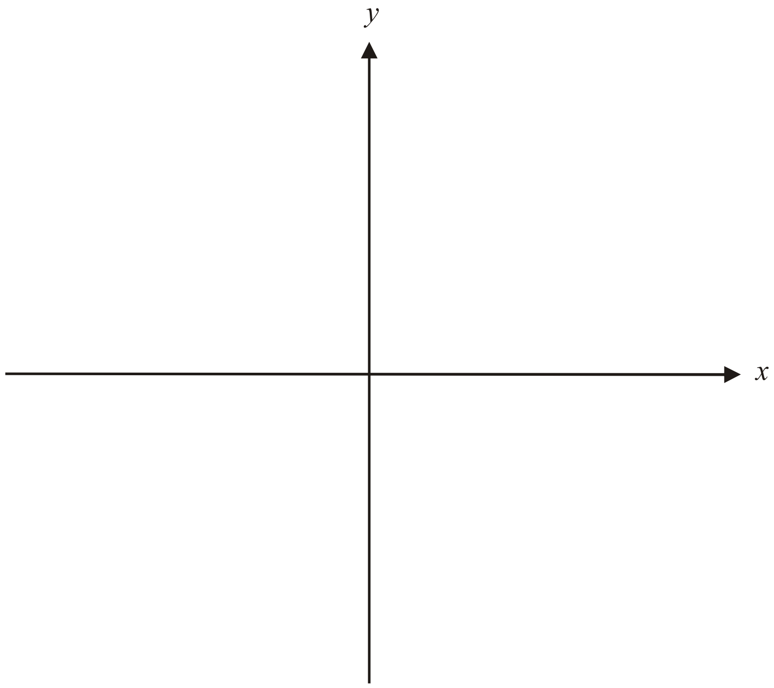
a. Verify that *f* is a solution to the differential equation $\dfrac{dy}{dx}=\dfrac{-3x^2+3x+1}{2(1-x)^{\frac{3}{2}}}$

1 mark

b. Show that the graph of $y=f(x)$ does not have a point of inflection.

1 mark

c. Sketch the graph of $y = f(x)$ on the set of axes below. Indicate clearly on your graph all relevant features expressing coordinates correct to one decimal place.



2 marks

d. One solution of the differential equation $\frac{dy}{dx} = \frac{-3x^2 + 3x + 1}{2(1-x)^{\frac{3}{2}}}$ has its turning point located at the point $(a, 0)$ where a is a negative constant. Use the information found in part **c.** to find this solution.

1 mark

e. Consider the solution to the differential equation $\frac{dy}{dx} = \frac{-3x^2 + 3x + 1}{2(1-x)^{\frac{3}{2}}}$ which satisfies the condition that $y = 1$ when $x = 0$.

At the point where $x = 0.2$ find the

i. approximate value of y using Euler's method and a step size of 0.1.
Express your answer correct to3 decimal places.

ii. actual y value. Express your answer correct to3 decimal places.

$2+1=3$ marks

f. Explain why the actual value of y found in part **e. ii.** is greater than the approximate value found in part **e. i.**

1 mark
Total 9 marks

Question 4

A window cleaner is suspended on a stationary platform on the outside of a high rise building. An object of mass 0.5kg, which has been at rest, drops from the platform and falls vertically. The object is subject to air resistance of $\frac{v}{100}$ newtons where v, in ms^{-1}, is the velocity of the object t seconds after it is dropped.

a. Draw a force diagram showing the forces acting on the object after it is dropped.

1 mark

b. Show that the acceleration a, in ms^{-2}, of the object is given by $a = g - \frac{v}{50}$.

1 mark

c. Hence show that $v = 50g(1 - e^{\frac{-t}{50}})$.

3 marks

d. **i.** On the set of axes below sketch the graph of the velocity time function $v = 50g(1 - e^{\frac{-t}{50}})$ for the object that was dropped.

ii. Find the limiting (terminal) velocity of the object.

$1 + 1 = 2$ marks

e. Whilst falling, the object passes a point that is 40 metres vertically below where it was dropped.
How long did the object take to reach this point? Express your answer in seconds correct to 2 decimal places.

2 marks

f. How far has the object travelled when it is moving at 50ms^{-1}? Express your answer in metres correct to 2 decimal places.

2 marks

g. Two seconds after the object is dropped, the window cleaner tries to retrieve the object by lowering the platform.
The platform accelerates at 1ms^{-2}.
How far above the object will the platform still be 3 seconds after the platform begins its motion? Express your answer in metres correct to 2 decimal places.

2 marks
Total 13 marks

Question 5

a. Show that the Cartesian equation of the relation $|z-1|=1, \quad z \in C,$ is given by $(x-1)^2+y^2=1$.

1 mark

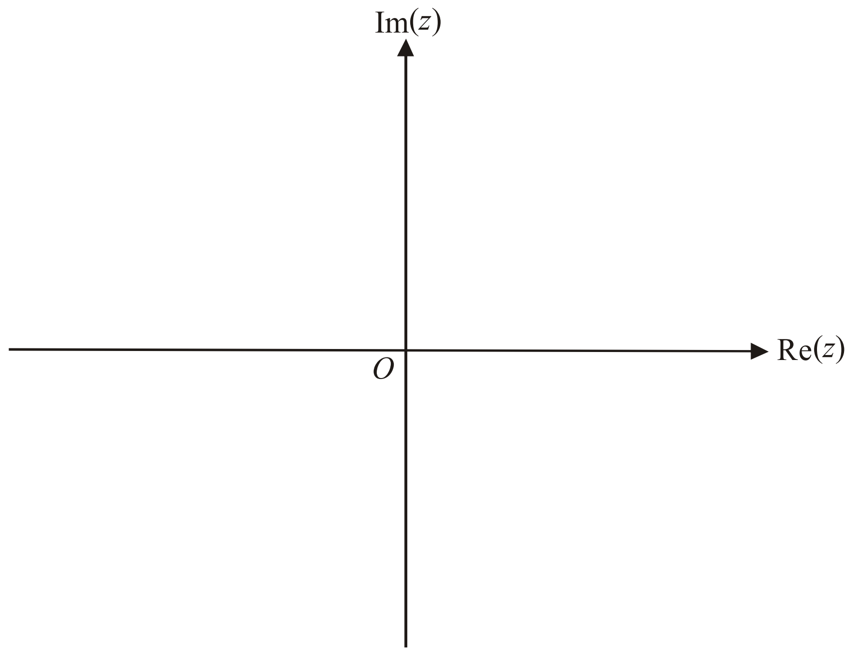
b. One of the points of intersection of the graphs of $|z-1|=1$ and $\text{Im}(z)=-\frac{1}{\sqrt{2}}$ is $V\left(1+\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}\right)$.

Find; using an algebraic approach, the coordinates of the other point of intersection.

2 marks

c. Sketch the graphs of $|z-1|=1$ and $\text{Im}(z)=-\frac{1}{\sqrt{2}}$ on the Argand diagram below.

Indicate clearly any intercepts and points of intersection.



2 marks

d. Find the area given by $\{z:|z-1|\le 1\}\cap\left\{z:\text{Im}(z)\ge-\frac{1}{\sqrt{2}}\right\}$.

2 marks

e. Use a double angle formula to show that $\tan\left(-\frac{\pi}{8}\right)=1-\sqrt{2}$.

Explain why any answers need to be rejected.

3 marks

f. **i.** Express the point $V\left(1+\frac{1}{\sqrt{2}},-\frac{1}{\sqrt{2}}\right)$ as a complex number in the form $v=a+bi$.

ii. Using your result from part **e.**, show that $\text{Arg}(v)=-\frac{\pi}{8}$.

$1+2=3$ marks
Total 13 marks

Specialist Mathematics Formulas

Mensuration

area of a trapezium:	$\frac{1}{2}(a+b)h$
curved surface area of a cylinder:	$2\pi rh$
volume of a cylinder:	$\pi r^2 h$
volume of a cone:	$\frac{1}{3}\pi r^2 h$
volume of a pyramid:	$\frac{1}{3}Ah$
volume of a sphere:	$\frac{4}{3}\pi r^3$
area of a triangle:	$\frac{1}{2}bc\sin A$
sine rule:	$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$
cosine rule:	$c^2=a^2+b^2-2ab\cos C$

Coordinate geometry

ellipse: $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ hyperbola: $\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$

Circular (trigonometric) functions

$\cos^2(x)+\sin^2(x)=1$

$1+\tan^2(x)=\sec^2(x)$ $\cot^2(x)+1=\operatorname{cosec}^2(x)$

$\sin(x+y)=\sin(x)\cos(y)+\cos(x)\sin(y)$ $\sin(x-y)=\sin(x)\cos(y)-\cos(x)\sin(y)$

$\cos(x+y)=\cos(x)\cos(y)-\sin(x)\sin(y)$ $\cos(x-y)=\cos(x)\cos(y)+\sin(x)\sin(y)$

$\tan(x+y)=\frac{\tan(x)+\tan(y)}{1-\tan(x)\tan(y)}$ $\tan(x-y)=\frac{\tan(x)-\tan(y)}{1+\tan(x)\tan(y)}$

$\cos(2x)=\cos^2(x)-\sin^2(x)=2\cos^2(x)-1=1-2\sin^2(x)$

$\sin(2x)=2\sin(x)\cos(x)$ $\tan(2x)=\frac{2\tan(x)}{1-\tan^2(x)}$

function	$\sin^{-1}$	$\cos^{-1}$	$\tan^{-1}$
domain	$[-1, 1]$	$[-1, 1]$	R
range	$\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$	$[0,\pi]$	$\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$

Algebra (Complex numbers)

$z=x+yi=r(\cos\theta+i\sin\theta)=r\operatorname{cis}\theta$

$|z|=\sqrt{x^2+y^2}=r$ $-\pi<\operatorname{Arg}z\le\pi$

$z_1z_2=r_1r_2\operatorname{cis}(\theta_1+\theta_2)$ $\frac{z_1}{z_2}=\frac{r_1}{r_2}\operatorname{cis}(\theta_1-\theta_2)$

$z^n=r^n\operatorname{cis}(n\theta)$ (de Moivre's theorem)

Calculus

$\frac{d}{dx}\left(x^n\right) = nx^{n-1}$ | $\int x^n\,dx = \frac{1}{n+1}x^{n+1} + c,\ n \neq -1$

$\frac{d}{dx}\left(e^{ax}\right) = ae^{ax}$ | $\int e^{ax}\,dx = \frac{1}{a}e^{ax} + c$

$\frac{d}{dx}\left(\log_e(x)\right) = \frac{1}{x}$ | $\int \frac{1}{x}\,dx = \log_e|x| + c$

$\frac{d}{dx}\left(\sin(ax)\right) = a\cos(ax)$ | $\int \sin(ax)\,dx = -\frac{1}{a}\cos(ax) + c$

$\frac{d}{dx}\left(\cos(ax)\right) = -a\sin(ax)$ | $\int \cos\,(ax)\,dx = \frac{1}{a}\sin(ax) + c$

$\frac{d}{dx}\left(\tan(ax)\right) = a\sec^2(ax)$ | $\int \sec^2(ax)\,dx = \frac{1}{a}\tan(ax) + c$

$\frac{d}{dx}\left(\sin^{-1}(x)\right) = \frac{1}{\sqrt{1-x^2}}$ | $\int \frac{1}{\sqrt{a^2-x^2}}\,dx = \sin^{-1}\left(\frac{x}{a}\right) + c,\ a > 0$

$\frac{d}{dx}\left(\cos^{-1}(x)\right) = \frac{-1}{\sqrt{1-x^2}}$ | $\int \frac{-1}{\sqrt{a^2-x^2}}\,dx = \cos^{-1}\left(\frac{x}{a}\right) + c,\ a > 0$

$\frac{d}{dx}\left(\tan^{-1}(x)\right) = \frac{1}{1+x^2}$ | $\int \frac{a}{a^2+x^2}\,dx = \tan^{-1}\left(\frac{x}{a}\right) + c$

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: $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$

Euler's method: If $\frac{dy}{dx} = f(x)$, $x_0 = a$ and $y_0 = b$,
then $x_{n+1} = x_n + h$ and $y_{n+1} = y_n + hf(x_n)$

acceleration: $a = \frac{d^2x}{dt^2} = \frac{dv}{dt} = v\frac{dv}{dx} = \frac{d}{dx}\left(\frac{1}{2}v^2\right)$

constant (uniform) acceleration: $v = u + at$ $\quad s = ut + \frac{1}{2}at^2$ $\quad v^2 = u^2 + 2as$ $\quad s = \frac{1}{2}(u+v)t$

Vectors in two and three dimensions

$\underset{\sim}{r} = x\underset{\sim}{i} + y\underset{\sim}{j} + z\underset{\sim}{k}$

$|\underset{\sim}{r}| = \sqrt{x^2 + y^2 + z^2} = r$ $\quad\quad$ $\underset{\sim}{r_1} . \underset{\sim}{r_2} = r_1 r_2 \cos\theta = x_1 x_2 + y_1 y_2 + z_1 z_2$

$$\dot{\underset{\sim}{r}} = \frac{d\underset{\sim}{r}}{dt} = \frac{dx}{dt}\underset{\sim}{i} + \frac{dy}{dt}\underset{\sim}{j} + \frac{dz}{dt}\underset{\sim}{k}$$

Mechanics

momentum: $\underset{\sim}{p} = m\underset{\sim}{v}$

equation of motion: $\underset{\sim}{R} = m\underset{\sim}{a}$

friction: $F \le \mu N$

SPECIALIST MATHEMATICS

TRIAL EXAMINATION 2

MULTIPLE- CHOICE ANSWER SHEET

STUDENT NAME:...

INSTRUCTIONS

Fill in the letter that corresponds to your choice. Example: A C D E

The answer selected is B. Only one answer should be selected.

1.	A	B	C	D	E	12.	A	B	C	D	E
2.	A	B	C	D	E	13.	A	B	C	D	E
3.	A	B	C	D	E	14.	A	B	C	D	E
4.	A	B	C	D	E	15.	A	B	C	D	E
5.	A	B	C	D	E	16.	A	B	C	D	E
6.	A	B	C	D	E	17.	A	B	C	D	E
7.	A	B	C	D	E	18.	A	B	C	D	E
8.	A	B	C	D	E	19.	A	B	C	D	E
9.	A	B	C	D	E	20.	A	B	C	D	E
10.	A	B	C	D	E	21.	A	B	C	D	E
11.	A	B	C	D	E	22.	A	B	C	D	E

