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SPECIALIST MATHEMATICS UNITS 3 & 4

TRIAL EXAMINATION 2

2017

Reading Time: 15 minutes
Writing time: 2 hours

Instructions to students

This exam consists of Section A and Section B.
Section A consists of 20 multiple-choice questions and should be answered on the detachable answer sheet which can be found on page 28 of this exam.
Section B consists of 6 extended-answer questions.
Section A begins on page 2 of this exam and is worth 20 marks.
Section B begins on page 11 of this exam and is worth 60 marks.
There is a total of 80 marks available.
All questions in Section A and B should be answered.
In Section B, where more than one mark is allocated to a question, appropriate working must be shown.
An exact value is required to a question unless otherwise directed.
Unless otherwise stated, diagrams in this exam are not drawn to scale.
The acceleration due to gravity should be taken to have magnitude $g\,\text{m/s}^2$ where $g = 9.8$
Students may bring one bound reference into the exam.
Students may bring into the exam 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, full functionality may be used.
A formula sheet can be found on pages 25-27 of this exam.

SECTION A – Multiple-choice questions

Question 1

The rule of the relation defined by the parametric equations $x = 2\tan(t) + 1$ and $y = 5\sec^2(t)$ is

A. $(x-1)^2 + y = 5$

B. $y = \dfrac{(x-1)^2}{4} + 1$

C. $y^2 = \dfrac{(x-1)^2}{4} - 1$

D. $y^2 = \dfrac{5(x-1)}{2} + 5$

E. $y = \dfrac{5(x-1)^2}{4} + 5$

Question 2

The implied domain and range of the function with rule $f(x) = 2\tan^{-1}(x+1) + \pi$ are given respectively by

A. R and $\left(\dfrac{-\pi}{2}, \dfrac{\pi}{2}\right)$

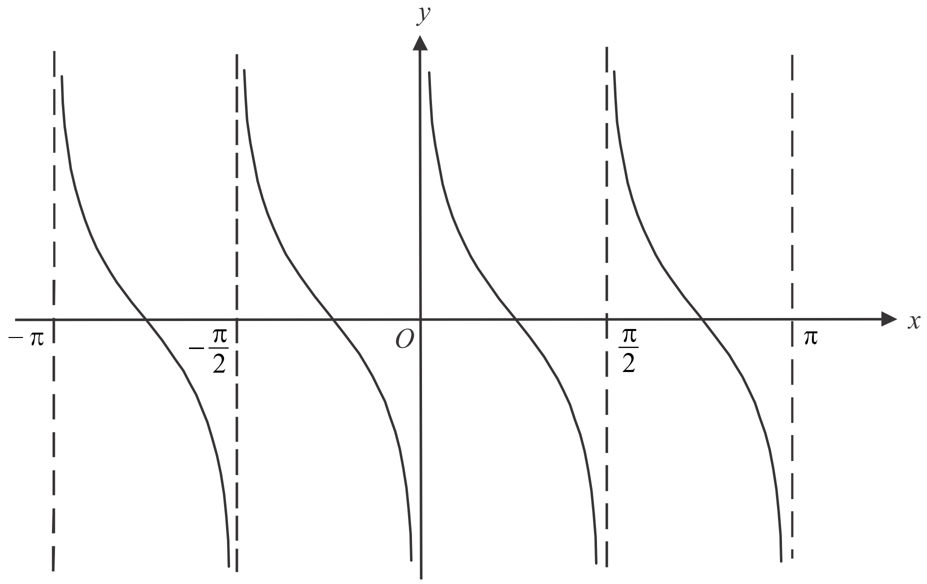
B. $(-2\pi, 2\pi)$ and R

C. R and $(0, 2\pi)$

D. $(0, 2\pi)$ and R

E. R and $(-\pi, \pi)$

Question 3



The rule for the function shown above could be

A. $y = \cot\left(\frac{x}{2}\right)$

B. $y = \cot\left(\frac{1}{2}\left(x - \frac{\pi}{2}\right)\right)$

C. $y = \cot\left(\frac{1}{2}\left(x - \frac{\pi}{4}\right)\right)$

D. $y = \cot\left(2\left(x - \frac{\pi}{2}\right)\right)$

E. $y = \cot\left(2\left(x - \frac{\pi}{4}\right)\right)$

Question 4

A polynomial $P(z)$ has real coefficients.
The equation $P(z) = 0$ has three known roots which are $z = 2$, $z = 3i$ and $z = 1 - i$.
The minimum number of roots that this equation could have is

A. 3
B. 4
C. 5
D. 6
E. 7

Question 5

Let $z^7 = a$ where $z \in C$ and a is a real constant. One of the solutions to this equation is
$|a|^{\frac{1}{7}}\text{cis}\left(-\frac{\pi}{7}\right)$.
Another solution is

A. $-|a|^{\frac{1}{7}}$

B. $|a|^{\frac{1}{7}}$

C. $|a|^{\frac{1}{7}}\text{cis}\left(\frac{2\pi}{7}\right)$

D. $|a|^{\frac{1}{7}}\text{cis}\left(\frac{4\pi}{7}\right)$

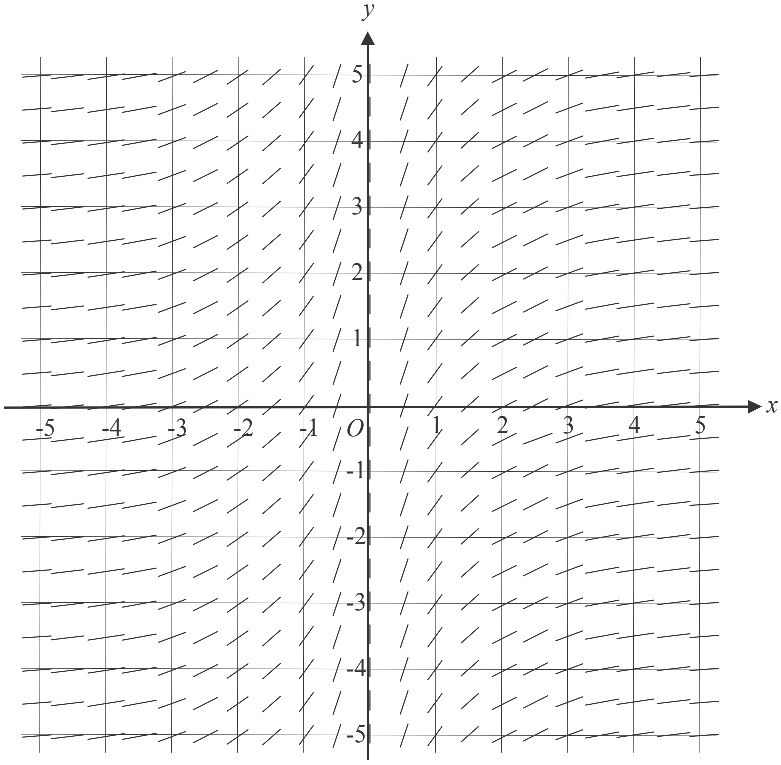
E. $|a|^{\frac{1}{7}}\text{cis}\left(\frac{3\pi}{2}\right)$

Question 6

Let $z_1 = \text{cis}\left(\frac{3\pi}{4}\right)$ and $z_2 = 0 + 0i$.
The points in the complex plane corresponding to z_1 and z_2 are joined to a third point corresponding to the complex number z_3. These three points form the vertices of a right-angled triangle.
The complex number z_3 could **not** be

A. $-iz_1$
B. $-\sqrt{2}$
C. $\bar{z}_1$
D. $\frac{i}{\sqrt{2}}$
E. $i^2 z_1$

Question 7



The direction field for the differential equation $\frac{dy}{dx} - \frac{1}{x^2} = 0$ is shown above.

One solution to this differential equation includes the point $(1, -1)$.
This solution is most likely to include

A. $(-3, 1)$

B. $(0, -2)$

C. $(2, 1)$

D. $(2, -0.5)$

E. $(3, 2)$

Question 8

Using a suitable substitution, $\int_0^{\frac{\pi}{2}} 2\sin(x)\cos^3(x)dx$ can be written as

A. $-2\int_0^1 u^3\,du$

B. $2\int_0^1 u^3\,du$

C. $-\frac{1}{2}\int_0^1 u^3\,du$

D. $2\int_0^{\frac{\pi}{2}} u^3\,du$

E. $-2\int_0^{\frac{\pi}{2}} u^3\,du$

Question 9

Let $f:\left[0,\sqrt{2}\right]\to R,\ f(x)=\dfrac{4}{2+x^2}$.

The graph of f is rotated about the y-axis to form a solid of revolution.
The volume of the solid can be found by evaluating

A. $\dfrac{\pi}{4}\displaystyle\int_0^{\sqrt{2}}\tan^{-1}\left(\frac{x}{2}\right)dx$

B. $\dfrac{\pi}{4}\displaystyle\int_1^{2}\tan^{-1}\left(\frac{x}{2}\right)dx$

C. $2\pi\displaystyle\int_1^{2}\frac{2-y}{y}dy$

D. $2\pi\displaystyle\int_0^{\sqrt{2}}\frac{2-y}{y}dy$

E. $\pi\displaystyle\int_{\sqrt{2}}^{2}\left(\sqrt{\frac{4}{y}}-2\right)dy$

Question 10

Let $\dfrac{dy}{dx}=x\,(2-x^2)$, where $y_0=y(1)=0$.

Using Euler's formula with step size 0.1, the value of y_3 is

A. 0.1199
B. 0.1672
C. 0.1869
D. 0.2541
E. 0.2969

Question 11

A tank contains 80 kg of sugar dissolved in 900 L of water.
A solution containing 0.5 kg of sugar per litre is pumped into the tank at the rate of 6 L/min.
The solution in the tank is kept uniform by stirring and flows out of the tank at the rate of 12 L/min.
Let x be the amount of sugar in the tank after t minutes.
A differential equation relating x and t is

A. $\dfrac{dx}{dt}=3-\dfrac{2}{150-t}$

B. $\dfrac{dx}{dt}=6-\dfrac{2}{900-6t}$

C. $\dfrac{dx}{dt}=3-\dfrac{2x}{150-t}$

D. $\dfrac{dx}{dt}=3-\dfrac{2}{150+6t}$

E. $\dfrac{dx}{dt}=6-\dfrac{x}{900-6t}$

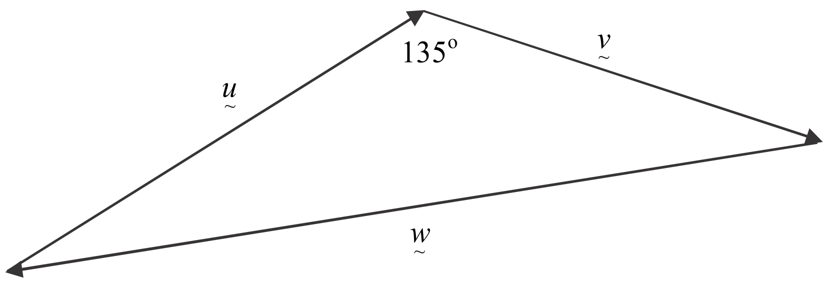
Question 12

An ice sculpture in the shape of a sphere is removed from a freezer and begins to melt. The radius of the sculpture *r,* in cm, *t* hours after it is removed from the freezer is given by $r = 4\sqrt{9-t^2}$. The rate, in cm^3/hr, at which the volume *V*, of the sculpture is decreasing, two hours after it is removed from the freezer is closest to

A. 281
B. 445
C. 608
D. 3254
E. 3597

Question 13

Vectors $\underset{\sim}{u}, \underset{\sim}{v}$ and $\underset{\sim}{w}$ are shown below.



It follows that

A. $|\underset{\sim}{w}|^2 = |\underset{\sim}{u}|^2 + |\underset{\sim}{v}|^2 - \sqrt{2}\,|\underset{\sim}{u}|\,|\underset{\sim}{v}|$

B. $|\underset{\sim}{w}|^2 = |\underset{\sim}{u}|^2 + |\underset{\sim}{v}|^2 + \sqrt{2}\,|\underset{\sim}{u}|\,|\underset{\sim}{v}|$

C. $|\underset{\sim}{w}|^2 = |\underset{\sim}{u}|^2 + |\underset{\sim}{v}|^2$

D. $|\underset{\sim}{w}|^2 = |\underset{\sim}{u}|^2 + |\underset{\sim}{v}|^2 - 2\,|\underset{\sim}{u}|\,|\underset{\sim}{v}|$

E. $|\underset{\sim}{w}|^2 = |\underset{\sim}{u}|^2 + |\underset{\sim}{v}|^2 + |\underset{\sim}{u}.\underset{\sim}{v}|$

Question 14

A particle starts from rest and has an acceleration vector given by

$\underset{\sim}{a}(t) = e^{\frac{t}{2}}\underset{\sim}{i} + \cos(2t)\underset{\sim}{j} - \sin(t)\underset{\sim}{k}$, where $t \ge 0$.

The velocity vector of the particle, $\underset{\sim}{v}(t)$, is given by

A. $\underset{\sim}{v}(t) = \dfrac{e^{\frac{t}{2}}}{2}\underset{\sim}{i} - 2\sin(2t)\underset{\sim}{j} - \cos(t)\underset{\sim}{k}$

B. $\underset{\sim}{v}(t) = \dfrac{1}{2}(e^{\frac{t}{2}} - 1)\underset{\sim}{i} - 2\sin(2t)\underset{\sim}{j} - (\cos(t) + 1)\underset{\sim}{k}$

C. $\underset{\sim}{v}(t) = 2e^{\frac{t}{2}} + \dfrac{1}{2}\sin(2t)\underset{\sim}{j} + \cos(t)\underset{\sim}{k}$

D. $\underset{\sim}{v}(t) = 2(e^{\frac{t}{2}} - 1)\underset{\sim}{i} + \dfrac{1}{2}\sin(2t)\underset{\sim}{j} + (1 - \cos(t))\underset{\sim}{k}$

E. $\underset{\sim}{v}(t) = 2(e^{\frac{t}{2}} - 1)\underset{\sim}{i} + \dfrac{1}{2}\sin(2t)\underset{\sim}{j} + (\cos(t) - 1)\underset{\sim}{k}$

Question 15

A mass of 6 kg moves in a straight line whilst acted on by a variable force of F newtons. The velocity, v metres per second, and position x metres from the origin at time t seconds, where $t \ge 0$, is given by $v^2 = x^2 - 5x$.
The force F is given by

A. $F = x - \dfrac{5}{2}$
B. $F = 6x - 15$
C. $F = 6x - 30$
D. $F = 12x - 30$
E. $F = 6x^2 - 30x$

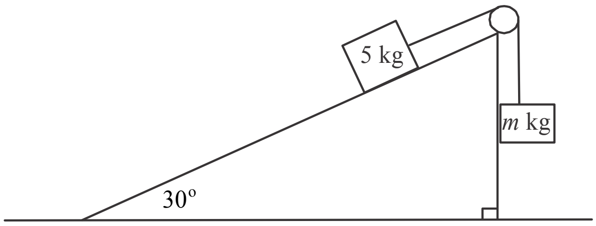
Question 16

A particle of mass 6 kg is moving in a straight line in an easterly direction at 5 ms^{-1}. A force acts on the particle causing it to move in an easterly direction at 1 ms^{-1}.
The change in momentum of the particle in kg ms^{-1}, in an easterly direction is

A. –30
B. –24
C. –6
D. 24
E. 30

Question 17

A package of mass 5 kg sits on a smooth plane inclined at an angle of 30° to the horizontal.
This package is connected by a light inextensible string that passes over a smooth pulley to a second package of mass m kg.
The packages are in equilibrium.



The value of m is

A. $\frac{5}{2}$
B. $\frac{5g}{2}$
C. 5
D. 5g
E. 10

Question 18

At a chocolate factory, wrapped chocolates have a mean mass of 32 g with a standard deviation of 3 g and unwrapped chocolates have a mean mass of 25 g with a standard deviation of 2 g.
The masses of the wrapped and unwrapped chocolates are independent of one another.
The mean mass and standard deviation, in grams, of two randomly selected wrapped chocolates and two randomly selected unwrapped chocolates are given respectively by

A. 114 and $\sqrt{26}$
B. 114 and $\sqrt{42}$
C. 171 and $3\sqrt{19}$
D. 228 and $2\sqrt{5}$
E. 228 and $\sqrt{10}$

Question 19

The time that competitors take to complete an endurance event is normally distributed with a mean time of 7 hours and a standard deviation of 0.5 hours.
A random sample of 64 competitors is selected.
The probability that the mean time that this sample of competitors take to complete the event is less than 7.1 hours is

A. 0.0548
B. 0.5636
C. 0.5793
D. 0.9452
E. 0.9993

Question 20

Researchers conducting a statistical test involving hypotheses H_0 and H_1 make a type II error. This means that they

A. reject H_0 when it is true.
B. do not reject H_0 when it is false.
C. reject H_1 when it is true.
D. do not reject H_1 when it is false.
E. reject H_1 when it is false.

SECTION B

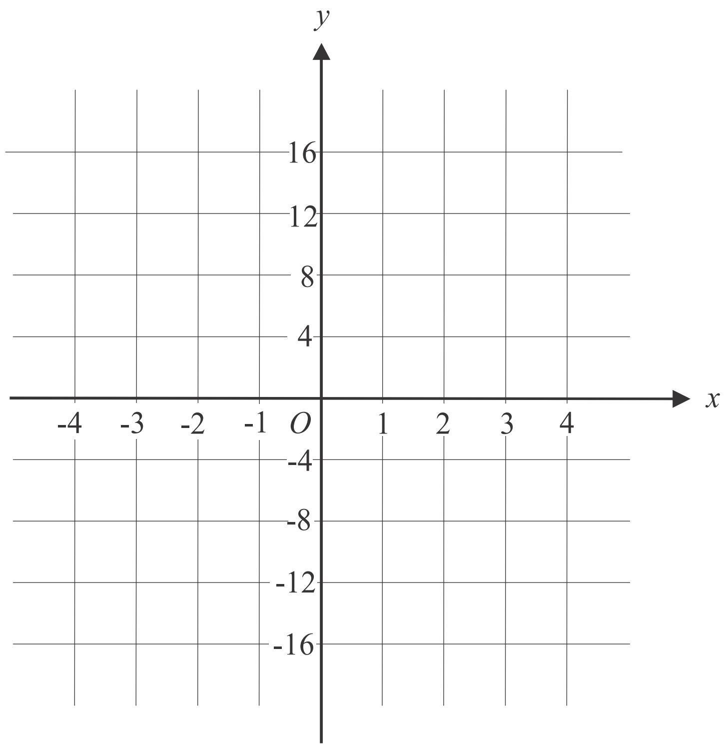
Question 1 (10 marks)

Consider the function *f* with rule $f(x)=\dfrac{x^4-x}{x^2}$ over its maximal domain.

a. Find the coordinates of the stationary point of the graph of *f*. Express values correct to two decimal places. 1 mark

b. State the equations of all asymptotes of the graph of *f*. 2 marks

c. On the set of axes below, sketch the graph of $f(x)=\dfrac{x^4-x}{x^2}$ for $x \in [-4, 4]$. Label the turning point, the point of inflection and the endpoints with their coordinates correct to two decimal places where required. Also label the asymptotes with their equations. 3 marks



The region enclosed by the graph of f, the x-axis and the line with equation $x = 4$ is rotated about the x-axis to form a solid of revolution.

d. **i.** Write down a definite integral which gives the volume of the solid formed. 1 mark

ii. Find this volume, correct to the nearest whole number. 1 mark

Consider that part of the graph of f for which $x \in (0,4]$ and $f''(x) \geq 0$.

e. Find the length of this curve, correct to two decimal places. 2 marks

Question 2 (13 marks)

A circle in the complex plane is given by $|z+2|=2,\ z\in C$.

a. Find the Cartesian equation of this circle. 1 mark

A ray given by $\text{Arg}(z)=\dfrac{11\pi}{12},\ z\in C$, has the Cartesian equation $y=ax,\ x<0$, where $a\in R$.

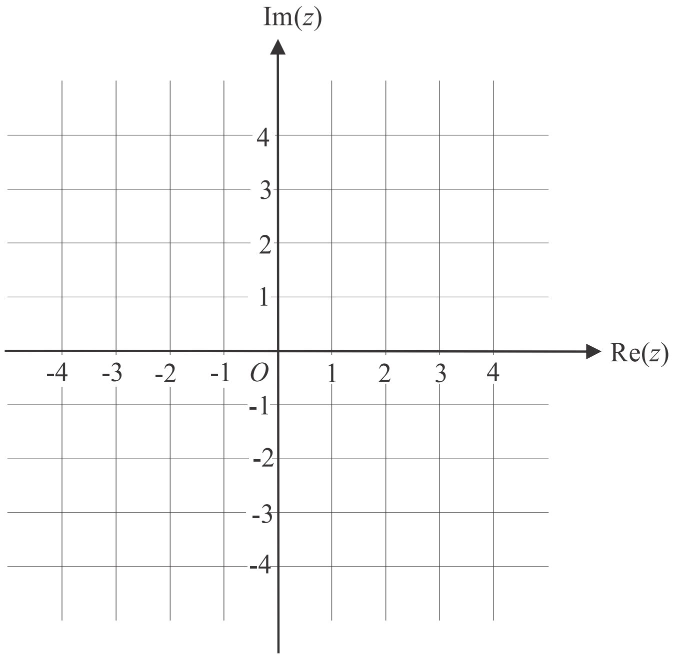
b. **i.** Show that $\tan\left(\dfrac{2\pi}{3}+\dfrac{\pi}{4}\right)=\sqrt{3}-2$. 2 marks

ii. Hence find the value of *a*. 2 marks

c. Find the point of intersection of the circle $|z+2|=2$ and the ray $\text{Arg}(z)=\dfrac{11\pi}{12}$. 2 marks

d. Sketch the circle $|z+2|=2$ and the ray $\text{Arg}(z)=\dfrac{11\pi}{12}$ on the Argand diagram below.

Label any points of intersection. 2 marks



e. The ray $\text{Arg}(z) = \frac{11\pi}{12}$ divides the circle into two segments. Find the area of the minor segment. 2 marks

f. Find the values of α, where $\alpha \in R$, for which the ray $\text{Arg}(z) = \frac{\alpha\pi}{2}$ intersects with the circle $|z+2| = 2$. 2 marks

Question 3 (10 marks)

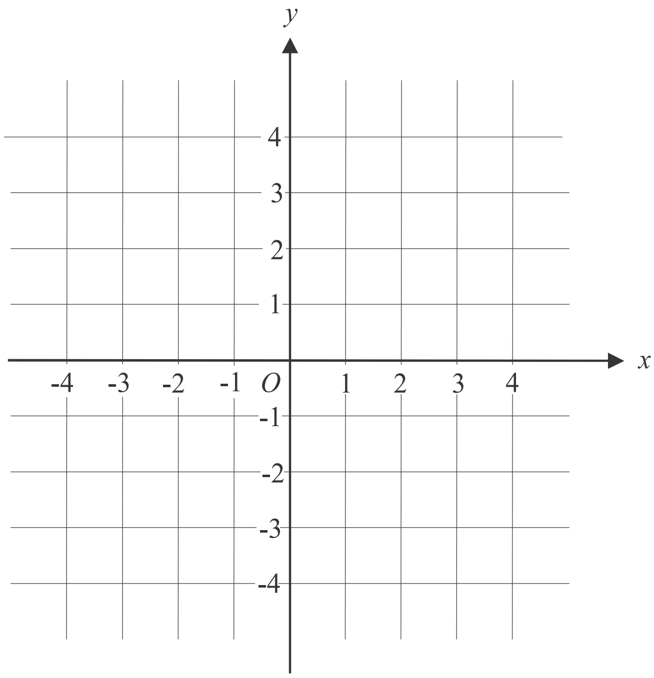
The position of two bodies A and B from a fixed origin at time t seconds, $t \geq 0$, is given respectively by

$$\underset{\sim}{r}_A = \sqrt{3}t\,\underset{\sim}{i} + (3t+1)\,\underset{\sim}{j}$$
$$\underset{\sim}{r}_B = 2\sin(t)\,\underset{\sim}{i} + 2\cos(t)\,\underset{\sim}{j}$$

where components are measured in metres.

a. Find the distance, in metres, between the starting positions of the two bodies. 1 mark

b. Sketch and label the path of each body on the axes below. Show the starting point and use an arrow to indicate the direction of motion of each body. 3 marks



c. Show that at $t=\frac{\pi}{6}$, the paths of the two bodies are at right angles to each other. 2 marks

d. Find the ratio of the speed of body A to the speed of body B. 2 marks

A third body C has a position vector given by

$$\underset{\sim}{r}_c = \sqrt{5}\,\underset{\sim}{j} \quad t \geq 0$$

where components are measured in metres and time is measured in seconds.

e. Find the minimum distance, in metres, between body B and body C and the value(s) of t for which this occurs. 2 marks

Question 4 (8 marks)

A differential equation relating the variables y and x is given by

$$\frac{dy}{dx} = e^{a(x-y)}$$

where a is a positive constant.

a. The differential equation can be expressed in the form $\frac{dy}{dx} = f(x)\,g(y)$.
Find $f(x)$ and $g(y)$. 1 mark

b. Solve the differential equation to find y in terms of x given that $y = 0$ when $x = 1$. 3 marks

Let $y = \log_e \sqrt{f(x) + 1 - e^2}$, using $f(x)$ from part **a.**.

c. **i.** Find $\dfrac{dy}{dx}$. 1 mark

ii. Verify by substitution that when $a = 2$, $y = \log_e \sqrt{f(x) + 1 - e^2}$ satisfies **both** the differential equation and the initial condition (given in part **b.**). 3 marks

Question 5 (9 marks)

The mean amount of sugar in a sports drink is 6 g/100 mL, with a standard deviation of 0.8 g/100 mL, according to the manufacturer.

a. The random variable $\overline{X}$ represents the mean amount of sugar, in grams per 100 mL, found in a random sample of 100 bottles of the sports drink.
Find the mean and standard deviation of $\overline{X}$. 2 marks

A consumer watchdog takes a random sample of 100 bottles of the sports drink. The mean amount of sugar in these bottles is found to be 6.2 g/100 mL. A statistical test is undertaken to see whether this sample provides evidence that the mean amount of sugar is higher than the manufacturer claims.

b. **i.** Write down appropriate hypotheses, H_0 and H_1, to test whether the amount of sugar is higher than the manufacturer claims. 2 marks

ii. Find the *p* value for this test, correct to four decimal places. 2 marks

iii. Using a test at the 5% level of significance, state whether or not the sample provides evidence that the mean amount of sugar is higher than the manufacturer claims. 1 mark

Some time later, this same statistical test is repeated by the consumer watchdog. A new random sample of 100 bottles of the sports drink is taken.
For this second test, the p value is found to be 0.0132 correct to four decimal places.

c. When compared to the first test, explain whether this second test provides stronger or weaker evidence that the mean amount of sugar is higher than the manufacturer claims. 1 mark

The consumer watchdog repeats the test once more taking a new random sample of 100 bottles of the sports drink.
This time however it is testing at the 1% level of significance.

d. What is the least value of the sample mean that would support the view that the amount of sugar is higher than the manufacturer claims. That is, if $\Pr(\overline{X} > \bar{x}_m \mid \mu = 6) = 0.01$, find $\bar{x}_m$, correct to four decimal places. 1 mark

Question 6 (10 marks)

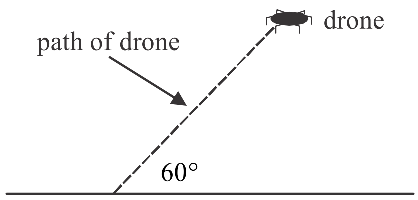
A drone of mass 4 kg is on its first test flight.
It starts from rest on the ground and is propelled vertically upwards by a force of $(60-2t)$ newtons, where t is the time in seconds after the drone leaves the ground and $t \in [0,10]$.
Assume that the only forces acting on the drone are gravity and the propulsion force and that air resistance is neglible.

a. Let a ms^{-2} be the acceleration of the drone t seconds after it leaves the ground.
Use the equation of motion for the drone to show that $a = \frac{26}{5} - \frac{t}{2}$. 1 mark

b. Let v ms^{-1} be the velocity of the drone t seconds after it leaves the ground.
Find v when $t = 10$. 2 marks

c. When $t = 10$, the propulsion system fails and the drone becomes subject to just gravity.
Calculate how much higher the drone reaches after the propulsion system fails before falling vertically to the ground. Give your answer in metres correct to two decimal places. 3 marks

The drone is repaired.
On its second test flight, the drone is propelled from rest off the ground and travels at 2 ms^{-1} moving in a straight line at an angle of 60° with the ground.



When the drone has travelled 20 metres, its propulsion system fails again, leaving the drone subject only to gravity.

d. Find the magnitude and direction of the vertical component of the drone's velocity when its propulsion system fails. 1 mark

e. How many seconds after the propulsion system fails does the drone hit the ground? Give your answer correct to three decimal places. 3 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	$c^2=a^2+b^2-2ab\cos(C)$

Circular functions

$\cos^2(x)+\sin^2(x)=1$	
$1+\tan^2(x)=\sec^2(x)$	$\cot^2(x)+1=\operatorname{cosec}^2(x)$
$\sin(x+y)=\sin(x)\cos(y)+\cos(x)\sin(y)$	$\sin(x-y)=\sin(x)\cos(y)-\cos(x)\sin(y)$
$\cos(x+y)=\cos(x)\cos(y)-\sin(x)\sin(y)$	$\cos(x-y)=\cos(x)\cos(y)+\sin(x)\sin(y)$
$\tan(x+y)=\frac{\tan(x)+\tan(y)}{1-\tan(x)\tan(y)}$	$\tan(x-y)=\frac{\tan(x)-\tan(y)}{1+\tan(x)\tan(y)}$
$\cos(2x)=\cos^2(x)-\sin^2(x)=2\cos^2(x)-1=1-2\sin^2(x)$	
$\sin(2x)=2\sin(x)\cos(x)$	$\tan(2x)=\frac{2\tan(x)}{1-\tan^2(x)}$

Circular functions – continued

Function	$\sin^{-1}$ or $\arcsin$	$\cos^{-1}$ or $\arccos$	$\tan^{-1}$ or $\arctan$
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)

$z = x + iy = r(\cos(\theta) + i\sin(\theta)) = r\text{cis}(\theta)$	
$\lvert z\rvert = \sqrt{x^2 + y^2} = r$	$-\pi < \text{Arg}(z) \le \pi$
$z_1 z_2 = r_1 r_2 \text{cis}(\theta_1 + \theta_2)$	$\frac{z_1}{z_2} = \frac{r_1}{r_2}\text{cis}(\theta_1 - \theta_2)$
$z^n = r^n \text{cis}(n\theta)$ (de Moivre's theorem)	

Probability and statistics

for random variables X and Y	$\text{E}(aX + b) = a\text{E}(x) + b$ $\text{E}(aX + bY) = a\text{E}(x) + b\text{E}(Y)$ $\text{var}(aX + b) = a^2\text{var}(X)$
for independent random variables X and Y	$\text{var}(aX + bY) = a^2\text{var}(X) + b^2\text{var}(Y)$
approximate confidence interval for μ	$\left(\bar{x} - z\frac{s}{\sqrt{n}},\ \bar{x} + z\frac{s}{\sqrt{n}}\right)$
distribution of sample mean $\bar{X}$	mean $\text{E}(\bar{X}) = \mu$ variance $\text{var}(\bar{X}) = \frac{\sigma^2}{n}$

Calculus

$\frac{d}{dx}\left(x^n\right)=nx^{n-1}$	$\int x^n\,dx=\frac{1}{n+1}x^{n+1}+c,\ n\neq -1$
$\frac{d}{dx}\left(e^{ax}\right)=ae^{ax}$	$\int e^{ax}\,dx=\frac{1}{a}e^{ax}+c$
$\frac{d}{dx}\left(\log_e(x)\right)=\frac{1}{x}$	$\int \frac{1}{x}\,dx=\log_e\lvert x\rvert+c$
$\frac{d}{dx}\left(\sin(ax)\right)=a\cos(ax)$	$\int \sin(ax)\,dx=-\frac{1}{a}\cos(ax)+c$
$\frac{d}{dx}\left(\cos(ax)\right)=-a\sin(ax)$	$\int \cos\,(ax)\,dx=\frac{1}{a}\sin(ax)+c$
$\frac{d}{dx}\left(\tan(ax)\right)=a\sec^2(ax)$	$\int \sec^2(ax)\,dx=\frac{1}{a}\tan(ax)+c$
$\frac{d}{dx}\left(\sin^{-1}(x)\right)=\frac{1}{\sqrt{1-x^2}}$	$\int \frac{1}{\sqrt{a^2-x^2}}\,dx=\sin^{-1}\left(\frac{x}{a}\right)+c,\ a>0$
$\frac{d}{dx}\left(\cos^{-1}(x)\right)=\frac{-1}{\sqrt{1-x^2}}$	$\int \frac{-1}{\sqrt{a^2-x^2}}\,dx=\cos^{-1}\left(\frac{x}{a}\right)+c,\ a>0$
$\frac{d}{dx}\left(\tan^{-1}(x)\right)=\frac{1}{1+x^2}$	$\int \frac{a}{a^2+x^2}\,dx=\tan^{-1}\left(\frac{x}{a}\right)+c$
	$\int (ax+b)^n\,dx=\frac{1}{a(n+1)}(ax+b)^{n+1}+c,\ n\neq -1$
	$\int (ax+b)^{-1}\,dx=\frac{1}{a}\log_e\lvert ax+b\rvert+c$
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	$a=\frac{d^2x}{dt^2}=\frac{dv}{dt}=v\frac{dv}{dx}=\frac{d}{dx}\left(\frac{1}{2}v^2\right)$
arc length	$\int_{x_1}^{x_2}\sqrt{1+(f'(x))^2}\,dx$ or $\int_{t_1}^{t_2}\sqrt{(x'(t))^2+(y'(t))^2}\,dt$

Vectors in two and three dimensions

$\underset{\sim}{r}=x\underset{\sim}{i}+y\underset{\sim}{j}+z\underset{\sim}{k}$
$\lvert\underset{\sim}{r}\rvert=\sqrt{x^2+y^2+z^2}=r$
$\dot{\underset{\sim}{r}}=\frac{d\underset{\sim}{r}}{dt}=\frac{dx}{dt}\underset{\sim}{i}+\frac{dy}{dt}\underset{\sim}{j}+\frac{dz}{dt}\underset{\sim}{k}$
$\underset{\sim}{r}_1\bullet\underset{\sim}{r}_2=r_1r_2\cos(\theta)=x_1x_2+y_1y_2+z_1z_2$

Mechanics

momentum	$\underset{\sim}{p}=m\underset{\sim}{v}$
equation of motion	$\underset{\sim}{R}=m\underset{\sim}{a}$

SPECIALIST MATHS

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