Perth Modern School

Yr 12 Maths Specialist

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Year 12 Specialist
TEST 5
20 Aug 2018
TIME: 50 minutes working
One page notes allowed
Classpads allowed
Classpads allowed

independent Public School

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PERTH MODERN SCHOOL

Name: Teacher:

Q1 (2 & 2 = 4 marks) Determine the general solution for the following.

$$x = \frac{\sqrt{b}}{\sqrt{b}} \sqrt{c}$$
 (6

$$\frac{(x \in -1)^x}{(x \cap -1)^x} = \frac{xp}{(xp)}$$

Q2 (4 matks) A hot item, initially at $315\,\mathrm{C}$, is placed in a room with temperature $21\,\mathrm{C}$ and left to cool, the temperature $T^\circ\mathrm{C}$ of the item t minutes later is given by the differential equation

 $(12 - T)\varepsilon = \frac{Tb}{3b}$

Determine how long it will take for the temperature of the item to cool to 100° C to the nearest second

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Q3 (2, 4 & 3 = 9 marks) The logistical growth model is given by the following differential equation.

$$\frac{dy}{dx} = ay - by^2$$

- $\frac{dy}{dx} = ay by^2$ where $a \otimes b$ are positive constants and y > 0a) State the y value where the gradient will be zero and hence give the limiting value of y.
 - b) Using separation of variables and partial fractions, derive the logistical formula

$$y = \frac{a}{b + Ce^{-ax}}$$
 where C is a constant. Show all steps without the use of a classpad.

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The Iron Man completes a race following a unique race track so that his position vector in metres

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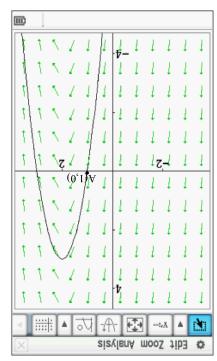
Q3 continued

be modelled by the logistical growth model $\frac{db}{dt} = \frac{db}{dt}$ c) Given that the Population $\,^{p}$ of a group of Kangaroos at t years (initially 285 kangaroos) can

taken for the population to reach 2000 kangaroos. Use your result from (b) , determine the time

.8 si bleif eqols A slope field is plotted below showing a particular line of force through point A(1,0). At point A the Q4 (4 marks)

through point A and the slope field in terms of x. Determine the equation of the line of force that the lines of force are parabolic. Given that the slopes are horizontal at x=2 and



Q9 (3 marks)

 $\int_{\frac{\pi}{2}} \frac{\varepsilon}{\sin s}$ $1\frac{\pi}{2}\cos 3$

at time $\,^{1}\,$ seconds is given by

The motion is graphed as follows.

Determine the time taken to complete one circuit of the race track and the length of this cicuit.

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Q5 (4 marks)

The Ant-Man is moving in a straight line so that his speed, V metres per second, at displacement X metres form the origin at time t seconds can be described by the following acceleration. The Ant-Man's speed is zero when x=1 metre from the origin.

$$\frac{dv}{dt} = x(5 + 3x^2)^5$$

Determine the approximate Ant-Man's speed when $\chi = 5$ metres.

Q6 (4 marks)

A particle is undergoing Simple Harmonic Motion and can be described by $\ddot{x} = -36x$. Determine what percentage of the time that the particle is **less than three quarters** of the maximum distance from the origin.

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Q7 (3 & 2 = 5 marks)

An object is undergoing SHM \ddot{x} =- 4x and is initially at rest with x =15 units but with a positive initial acceleration. Determine.

a) An expression for X in terms of time, t.

b) The distance travelled in the first 10 seconds.

Q8 (3 & 3 =6 marks)

An object's displacement, x metres at time, t seconds is described by $x = 7\cos(3t) - 5\sin(3t)$

a) Show that the motion is Simple Harmonic.

b) Determine the Amplitude and the **exact** speed when x=4 metres.