PERTH MODERN SCHOOL
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Independent Public School

Year 12 Methods
TEST 1
Friday 22 February 2019
TIME: 45 minutes working
One-page notes allowed
Calculator Assumed
39 marks 7 Questions

Name: _____ Teacher: _____

Note: All part questions worth more than 2 marks require working to obtain full marks.

Question 1 **(6 marks)**

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	3	1	-2	-1
2	2	-1	1	0
3	1	-2	2	1

(a) Define $h(x)=\dfrac{f(x)}{g(x)}$, use the table to find the value for $h'(2)$. (3 marks)

(b) Define $I(x)=\left[g(x)\right]^5$, use the table to find the value for $I'(1)$. (3 marks)

Question 2 **(3 marks)**

Find the equation of the line tangent to the function $y=\left(3x^2-2\right)^3$ at the point $(2,2)$. Give your answer in the gradient-intercept form.

Question 3 **(3 marks)**

If $\frac{dy}{dx}=(5x+3)^3$, and $y=50$ when $x=1$, determine the expression of y in terms of x.

Question 4 **(7 marks)**

A company is purchasing a type of thin sheet metal required to make a closed cylindrical container with a capacity of 4000π cm^3. Let the radius of the cylindrical base be r and the height be h.

(a) Show that the surface area of the cylinder can be expressed as $2\pi r^2 + \frac{8000\pi}{r}$.

(3 marks)

(b) Using calculus, determine the least area of metal required to make a closed cylindrical container from thin sheet metal in order that it will have a capacity of 4000π cm^3.
(Work to one decimal place) (4 marks)

Question 5 **(6 marks)**

A share portfolio, initially worth \$26 000, has a value of f dollars after t months, and begins with a negative rate of growth. The rate of growth remains negative until after 20 months $(t = 20)$ when the value of the portfolio is momentarily stationary and then continues with negative growth for the life of the investment. The value of the portfolio, $f(t)$ after t months can be modelled by the following model, $f(t) = -2t^3 + bt^2 + ct + d$, $0 \leq t \leq 37$ months where $b, c \& d$ are constants.

Determine the values of the constants $b, c \& d$.

Question 6 **(8 marks)**

The volume, V in cubic metres and radius R metres, of a spherical balloon are changing with time, t seconds. $V = \frac{4\pi R^3}{3}$. The radius of the balloon at any time is given by $R = 2t(t+3)^3$.

Determine the following:

a) The value of $\frac{dR}{dt}$ when $t = 1$. (3 marks)

b) The value of $\frac{dV}{dt}$ when $t = 1$. (3 marks)

Consider the volume of the balloon at $t = 1$.

c) Use the incremental formula to estimate the change in volume 0.1 seconds later (i.e. $t = 1.1$) (2 marks)

Question 7 **(6 marks)**

The position of a train on a straight mono rail, x metres at time t seconds, is modelled by the following formula for the velocity, v in metres/second, $v = pt^2 - 12t + q$ where $p \& q$ are constants. The deceleration of the train is $8ms^{-2}$ when $t = 1$. The train has a position $x = \frac{4}{3}$ when $t = 2$ and is initially at the origin ($x = 0$).

a) Determine the values of the constants $p \& q$. (4 marks)

b) Determine the position of the train when the acceleration is $12ms^{-2}$. (2 marks)

Supplementary Page

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