PERTH MODERN SCHOOL
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Independent Public School

Year 12 Methods
TEST 1
Friday 22 February 2019
TIME: 45 minutes working
Calculator Assumed
38 marks 8 Questions

Name: ________________________________ Teacher: ____________________________

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

Question 1 **(4 marks)**

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

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

(b) Define $I(x)=f(g(x))$, use the table to find the value for $I'(3)$. (2 marks)

Question 2 **(3 marks)**

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

Question 3 **(4 marks)**

Consider the cubic polynomial $y=Ax^3+6x^2-Bx$, where *A* and *B* are unknown constants. If possible, find the values of *A* and *B* so that the graph of *y* has a minimum value at $x=-1$ and a point of inflection at $x=1$; if not possible, explain why not.

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.

(a) Let the radius of the cylindrical base be r. Find the expression for the height h in terms of r. (1 mark)

(b) Hence, find the expression for the surface area of the cylinder in terms of r. (2 marks)

(c) Therefore, find 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. (4 marks)

Question 5 **(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 $t = 1$, 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) The distance travelled when the acceleration is $12ms^{-2}$. (2 marks)

Question 7 **(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 8 **(6 marks)**

A share portfolio, initially worth $26000, 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, $f(t) = -2t^3 + bt + ct + d$, $0 \le t \le 37$ months where $b, c \,\&\, d$ are constants.

Determine the values of the constants.