PERTH MODERN SCHOOL Exceptional schooling. Exceptional students. 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 **(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 $y=\left(3x^2-2\right)^3$ at the point $(2,2)$. Give your answer in the gradient-intercept form.

Question 3 **(3 marks)**

The time period T for a simple pendulum of length l is given by $T=2\pi\sqrt{\frac{l}{g}}$ where g is a constant. If the length changes by 3%, use the incremental formula to estimate the percentage change in the period.

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) 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 **(8 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) Determine the time(s) that the velocity is zero. (2 marks)

c) The distance travelled when the acceleration is $12ms^{-2}$. (2 marks)

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)**

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, $f(t) = -2t^3 + bt^2 + ct + d$, $0 \leq t \leq 37$ months where $b, c \& d$ are constants.

Determine the values of the constants.