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| linear IPS | 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.**

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**Question 1 (4 marks)**

1. Define , use the table to find the value for (2 marks)
2. Define , use the table to find the value for . (2 marks)

**Question 2 (3 marks)**

Find the equation of the line tangent to the function at the point . Give your answer in the gradient-intercept form.

**Question 3 (3 marks)**

The time period  for a simple pendulum of length  is given by  where  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 4000 cm3.

1. Let the radius of the cylindrical base be Find the expression for the height in terms of (1 mark)
2. Hence, find the expression for the surface area of the cylinder in terms of (2 marks)
3. 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 4000 cm3.

(Work to one decimal place) (4 marks)

**Question 5 (8 marks)**

The position of a train on a straight mono rail,  metres at time  seconds, is modelled by the following formula for the velocity,  in metres/second,  where  are constants. The deceleration of the train is  when , has a position  when  and is initially at the origin ().

1. Determine the values of the constants . (4 marks)
2. Determine the time(s) that the velocity is zero. (2 marks)
3. The distance travelled when the acceleration is . (2 marks)

**Question 6 (8 marks)**

The volume,  in cubic metres and radius metres, of a spherical balloon are changing with time,  seconds. . The radius of the balloon at any time is given by .

Determine the following:

1. The value of  when . (3 marks)
2. The value of  when . (3 marks)

Consider the volume of the balloon at .

1. Use the incremental formula to estimate the change in volume 0.1 seconds later (i.e  )

(2 marks)

**Question 7 (6 marks)**

A share portfolio, initially worth $26000, has a value of dollars after  months, and begins with a negative rate of growth. The rate of growth remains negative until after 20 months  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,  after  months can be modelled by the following model, , months where  are constants.

Determine the values of the constants.