



**PERTH MODERN SCHOOL**  
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**Independent Public School**

## **Course 12 Specialist Test 3 & Investigation 2**

Test mark \_\_\_\_/24

Investigation mark \_\_\_\_/14

Student name: \_\_\_\_\_ Teacher name: \_\_\_\_\_

**Task type:** Response/Investigation

**Time allowed for this task:** 45 mins

**Number of questions:** 6 questions Test/ 1 question Inv

**Materials required:** Calculator with CAS capability (to be provided by the student)

**Standard items:** Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

**Special items:** Drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators approved for use in the WACE examinations

**Marks available:** 24 marks Test/ 14 marks Inv

**Task weighting:** Test 6 % Inv 8%

**Formula sheet provided:** Yes

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

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This first section will be recorded as test 3 in the assessment schedule.

Students decide how much time they will spend on each section, recommended 30 mins test & 15 mins Inv.

Q1 (3 marks)

Determine the equation of the tangent to  $x^3 + \frac{y}{x} = 2xy$  at the point  $(1,1)$ .

Q2 (3 marks)

If  $\frac{dy}{dx} = xy^2$  determine an expression for  $\frac{d^2y}{dx^2}$  in terms of  $x$  &  $y$ .

Q3 (2 & 3 = 5 marks)

If  $x = 3t^2 + 2t$  and  $y = 5t - \frac{1}{t}$  determine:

a)  $\frac{dy}{dx}$  in terms of  $t$ .

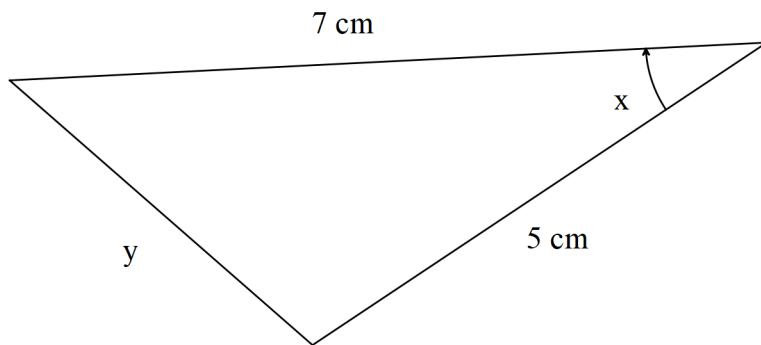
b)  $\frac{d^2y}{dx^2}$  in terms of  $t$ . (No need to simplify)

Q4 (4 marks)

Consider a metal sphere where the volume was measured and found to have an error of 5%. Use the **increments** formula to determine the **approximate** percentage error in the radius.

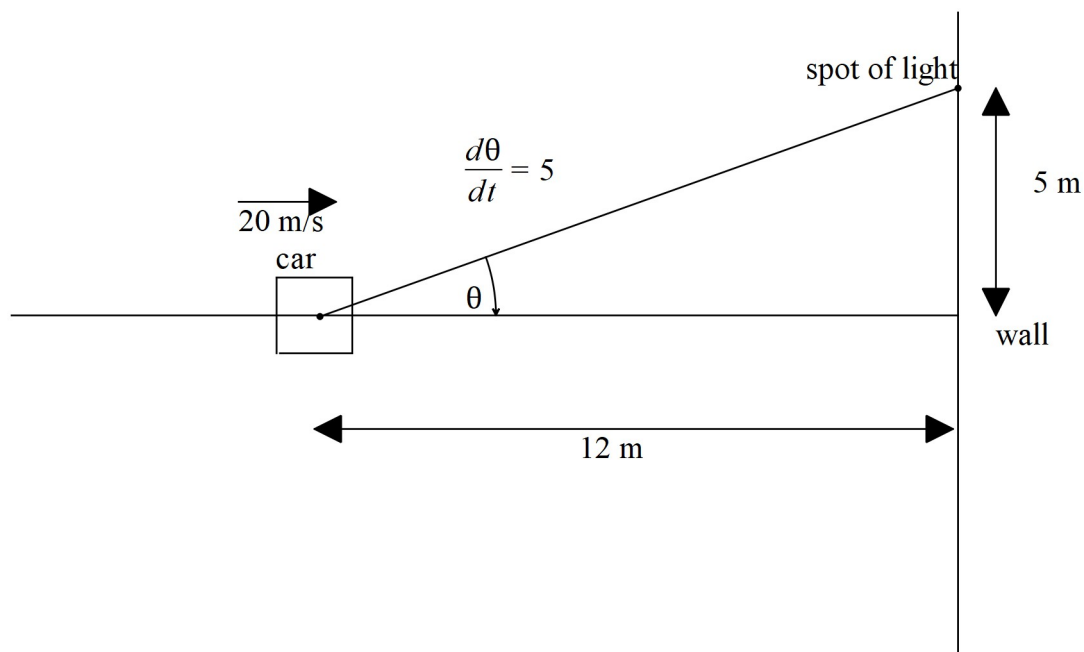
Q5 (4 marks)

Consider a triangle with angle  $x$  radians and opposite side length  $y$  cm, see diagram below. If the angle is changing at a rate of 3 radians/second, determine the **exact** time rate of change of  $y$  when  $x = \frac{\pi}{6}$ .



## Q6 (5 marks)

Consider a car moving at  $20$  metres/second towards a brick wall. On top of the car is a rotating light moving at an angular speed of  $5$  radians/second. When the light ray hits the wall a spot of light can be seen moving along the line of the wall. Determine the speed of this dot of light on the wall when the light on top of the car is  $12$  m from the wall and the spot of light  $5$  m from the central point as shown on the diagram below.



## Investigation section.

Q1 (3, 3, 4 & 4 = 14 marks)

Differentiate the following using logarithmic differentiation. Show **all steps** in this method.

a)  $y = x^5 (5 - 3x)^7$

b)  $y = \sqrt{\frac{5x - 2}{5x + 2}}$

c)  $y = 5^x$

d)  $y = (\sin x)^{\tan x}$