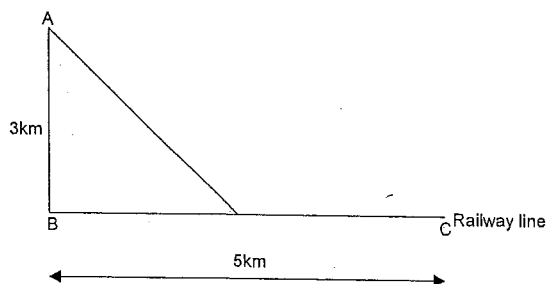


# Differential Calculus Test

1. Differentiate  $y = 3x^2 + 2x - 4$  from first principles (3 marks)
2. Differentiate with respect to  $x$  (2 marks each)
  - a.  $y = -5x^2 + 2x + 3$
  - b.  $y = \frac{3x+2}{x+5}$
  - c.  $y = (x+3)(x^3 - 7)^3$
  - d.  $y = \sqrt[4]{3x^2 + 2x}$
3. Find the equation of the normal to the curve  $y = 2\sqrt{x}$  at the point (9,6) (3 marks)
4. Find stationary points and sketch  $f(x) = x^3 + 6x^2 + 9x + 4$  (4 marks)
5. Evaluate (2 marks each)
  - a.  $\lim_{x \rightarrow 4} \frac{x^2 - x - 12}{x^2 - 16}$
  - b.  $\lim_{x \rightarrow \infty} \frac{x^2 - x - 12}{x^2 - 16}$
6. A rectangular plot of land is to be enclosed using an existing wall as one of the boundaries. 200m of fencing is to be used. (4 marks)
  - a. By letting the length be  $x$  metres, show that the breadth is  $(200 - 2x)$  metres. (1)
  - b. Find an expression for the enclosed area. (1)
  - c. Hence find the maximum area. (2)
7. Two towns B and C, 5km apart, are on a straight railway line running from East to West. A third town A is 3km north of B. A man wishes to travel from A to C by renting a car to drive to the railway line and then catching a train for the rest of the way. It costs \$2 a km to hire a car and \$1 a km to travel by train. Assuming he drives in a straight line from A to meet the railway line somewhere between B and C, towards what point of the railway line should he drive in order to minimise the cost of his trip? (4 marks)



Total: 30 marks