Write your name here

Surname		Other names

Grade One Paper
Level 1 / Level 2 GCSE
(9–1)

Centre Number

Candidate Number

Further Mathematics

Power Rules for Differentiation

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Paper Reference

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**

Information

- The total mark for this paper is 63
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

Q1   Find the derivative of $f(x) = 3x^4$

....

(2)

Q2 $y = 3x^4 + 5x^3 - 6x^{-1} + 3$

    a   Find the value of $\frac{dy}{dx}$.

....

(4)

    b   Find the gradient of y when x=4.

....

(3)

    c   Find the value of y when x=4.

....

(3)

Q3 $f(x) = 4x^3 - \frac{2}{x} + 8$

    a   Find the value of $f'(7)$

....

(3)

    b   Find the value of $f'\left(\frac{3}{8}\right)$

....

(3)

Q4 $y = x\sqrt{3x}$

    a   Find the value of $\frac{dy}{dx}$.

....

(2)

    b   Find the derivative of $\frac{1}{y}$.

....

(4)

Q5 $y = 3x^7 + \sqrt[3]{216x} + \frac{3}{2x^3}$

    a   Work out $\frac{dy}{dx}$.

....

(4)

    b   Work out the gradient of the curve where $x = 5$.

....

(3)

Q6 $y = x(x + 8)(2x - 7)(3x + 9)(4x + 3)$

Work out $\frac{dy}{dx}$.

....

(6)

Q7 $f(x) = \frac{5x + 7x^2}{x^3}$

    a   Find $f'(x)$.

....

(3)

    b   Find $f'(4)$.

....

(2)

Q8 $f(x) = 7 - \frac{x}{7} + \frac{5}{\sqrt[3]{x^2}}$

    Find $f'(8)$

....

(2)

Q9 $y = \frac{7}{x^3} + \frac{8}{x^5}$

Find an expression showing the rate of change of y with respect to x.

…………………………………………………………..

(3)

Q10   A car sets off from rest. For the first 20 seconds, the speed of the car can be modelled using the equation $x = 3t^2$.

a   Use this model to find the speed of the car after 13 seconds.

…………………………………………………………..

(2)

b   Find the acceleration of the car during the first 20 seconds of its journey.

…………………………………………………………..

(2)

Q11 An object is thrown with an initial speed of 6 ms^{-1} from a hot air balloon. The movement of the object can be modelled using the equation displacement, $s = 6t + \frac{9.81t^2}{2}$ where t is the time.

a Use this model to calculate the speed of the object after 25 seconds.

....

(4)

b Find the acceleration of the object.

....

(2)

Q12 For the graph $y = x^3 - 2x^2$, find the points where the graph crosses each axis and state the gradient of the graph at those points.

....

(4)