Name	Date started	Target end date

WJEC Level 2 Additional Mathematics — Question Pack

Differentiating polynomials term by term — including negative powers — the core calculus skill on every paper.

REVISE
.wales

Differentiation — techniques

Calculus · Level 2 Certificate (9550) · calculator allowed

Differentiating polynomials term by term — including negative powers — the core calculus skill on every paper.

LEVEL 2 · 9550

Estimated time for entire question pack: ~1 hours 31 minutes

*At the Additional Maths pace of **~1.2 min/mark** (76 marks across 16 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. It gathers every question on this topic from the 2011–2024 papers.

Questions are ordered by year, newest first.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

A calculator is allowed throughout this qualification.

Differentiation — techniques — what's examined

WJEC Level 2 Additional Mathematics (9550) · single written paper, calculator allowed.

The rule Calculus

- Multiply by the power, then reduce the power by 1.
- Differentiate each term separately.
- The derivative of a constant is 0.

Rewriting first Calculus

- Write roots and fractions as powers of x.
- Then apply the rule.
- Tidy back to a sensible form.

Notation Method

- dy/dx means the derivative.
- Apply it to every term.
- Simplify the final expression.

Crib sheet »

Differentiation — techniques in one page

Quick-reference notes — revisit before each question. Don’t use during the questions.

Power rule

$$y = ax^n \Rightarrow dy/dx = anx^{n-1}$$

Term by term

Differentiate each term of a polynomial independently and add the results.

Rewrite first

$1/x^2 = x^{-2}$, $\sqrt{x} = x^{(1/2)}$ — convert before differentiating.

Constants vanish

The derivative of any constant term is **0**.

1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 5x^6 - 2 + x^{-5}$ [3]

(b) $y = x^{\frac{7}{8}}$ [1]

(c) $y = \frac{3}{13x^4}$ [1]

12. Find $\frac{d^2y}{dx^2}$ when $y = 5x^{14}$. [2]

1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 3x^9 - 5 + x^{-8}$ [3]

(b) $y = x^{\frac{5}{6}}$ [1]

(c) $y = \frac{1}{4x^7}$ [1]

9. Find $\frac{d^2y}{dx^2}$ when $y = 2x^{12}$. [2]

10. (a) The coordinates of the points A and B are (4, 6) and (−8, 1) respectively.

(i) Calculate the length of the line AB. [2]

(ii) Find the gradient of a line perpendicular to the line AB. [3]

(iii) Find the coordinates of the midpoint of the line AB. [2]

1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 4x^8 - 5 + x^{-7}$ [3]

(b) $y = x^{\frac{1}{6}}$ [1]

(c) $y = \frac{1}{3x^5}$ [1]

10. (a) Find $\frac{d^2y}{dx^2}$ when $y = 3x^{10}$. [2]

(b) Given the following facts, find the values of a, b, c and d.

- $y = ax^3 + bx^2 + cx + d$
- $\frac{dy}{dx} = 27x^2 + 8x + 13$
- The value of d is equal to $\frac{1}{6}$ of the coefficient of x in $\frac{d^2y}{dx^2}$. [4]

$a =$ ..... $b =$ ..... $c =$ ..... $d =$ .....

11. (a) The coordinates of the points A and B are (12, 6) and (–3, 3) respectively.

(i) Calculate the length of the line AB.

Express your answer as a surd in its simplest form, $n\sqrt{m}$. [3]

(ii) Find the gradient of a line perpendicular to the line AB. [3]

(iii) Find the coordinates of the midpoint of the line AB. [2]

2. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 10x^4 + 3x^2 - 5.$ [3]

(b) $y = \frac{2}{x^{11}}.$ [1]

(c) $y = x^{\frac{7}{8}}.$ [1]

1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 5x^8 - 3x - 13 + x^{-1}$ [4]

(b) $y = x^{\frac{5}{6}}$ [1]

(c) $y = \frac{3}{x^6}$ [1]

2. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 7x^{10} - 5x - 22$ [3]

(b) $y = x^{-12}$ [1]

(c) $y = x^{\frac{3}{8}}$ [1]

(d) $y = \frac{1}{x^4}$ [1]

2. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 9x^4 + 4x^2 - 3$ [3]

(b) $y = x^{-8}$ [1]

(c) $y = x^{\frac{3}{4}}$ [1]

3. Prove that $\frac{3x}{2} - \frac{x-6}{5} + \frac{2x+3}{7} \equiv \frac{111x+114}{70}$. [4]

4. Given that $y = x^2 + 3x$, find $\frac{dy}{dx}$ from first principles. [5]

3. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 5x^8 - 6x - 9$ [3]

.....

.....

(b) $y = x^{-8}$ [1]

.....

.....

(c) $y = x^{\frac{2}{5}}$ [1]

.....

.....

4. The coordinates of the points *D* and *E* are (6, 22) and (–4, 14) respectively.

(a) Calculate the length of the line *DE*.
Express your answer as a surd in its simplified form $n\sqrt{m}$. [3]

(b) Find the equation of the straight line perpendicular to *DE* that passes through the mid-point of *DE*.
Express your answer in the form $ax + by + c = 0$, where a, b and c are integers. [8]

1. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 6x^5 + 7x - 2$ [3]

(b) $y = \frac{1}{x^6}$ [1]

(c) $y = x^{\frac{5}{2}}$ [1]

2. *(a)* Factorise $15x^2 - 14x - 8$. [4]

Hence solve the equation $15x^2 - 14x - 8 = 0$.

(b) Use the method of completing the square to find the least value of $x^2 + 10x + 3$. [3]

1. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 7x^5 - 5x - 2$

.....

.....

[3]

(b) $y = x^{-6}$

.....

.....

[1]

(c) $y = x^{\frac{3}{5}}$

.....

.....

[1]

2. *(a)* Factorise $8x^2 - 10x - 3$.

Hence solve the equation $8x^2 - 10x - 3 = 0$.

[4]

(b) Use the method of completing the square to find the least value of $x^2 + 12x + 5$.

[3]

3. Find $\frac{dy}{dx}$ for each of the following.

(a) $y = 8x^7 + 2x - 23$

.....

.....

[3]

(b) $y = x^{-8}$

.....

.....

[1]

(c) $y = x^{\frac{3}{2}}$

.....

.....

[1]

4. *(a)* Given that $f(x) = x^3 - 2x^2 - 9x + 18$, evaluate $f(-3)$.

Write down what this tells you about $f(x)$.

[3]

(b) Factorise $x^3 - 2x^2 - 9x + 18$.

[4]

5. Use the facts below to find the value of the constant a.

$$y = ax^3$$

$$\frac{dy}{dx} = 135 \text{ when } x = 3$$

[4]

2. Find $\frac{dy}{dx}$ for **each** of the following.

(a) $y = 8x^4 + 3x - 6$

.....

.....

[3]

(b) $y = x^{-4}$

.....

.....

[1]

(c) $y = x^{\frac{3}{4}}$

.....

End of question pack