WESSEX ACADEMIA

FROM GCSE TO GRADUATION

KNOWLEDGE
SKILLS
CONFIDENCE
BRIGHTER
FUTURES

$\frac{d}{dx}(x^n) = nx^{n-1}$

Real Science. Brighter Futures.

Mathematics 6.1

Differentiation

Polynomials & Powers

Build confidence with the power rule and the sum rule, including fractional and negative powers.

You will need to:

- rewrite expressions using index notation (*e.g.* $\sqrt{x} = x^{\frac{1}{2}}$, $\frac{1}{x} = x^{-1}$)
- use the power rule and the sum rule
- give your answers in simplest form

Differentiate each of the following functions with respect to x.

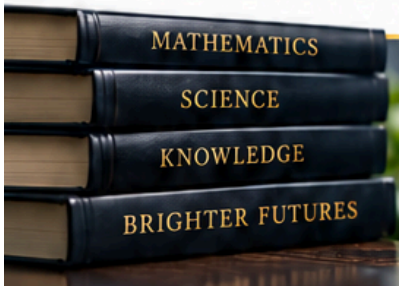
Where necessary, simplify your answer and write it as a sum of powers of x.

Small steps make big progress. ☺

1	$y = x^3$	[2 marks]
2	$y = 4x^5$	[2 marks]
3	$y = 7x^4 - 3x^2$	[2 marks]
4	$y = 5x^6 + 2x^3 - 8x$	[2 marks]
5	$y = 3x^7 - 4x^4 + 6x^2 - 9$	[3 marks]
6	$y = \sqrt{x}$	[2 marks]
7	$y = 5\sqrt{x} + 3x^2$	[3 marks]
8	$y = x^{\frac{3}{2}} + 4x^{\frac{1}{2}}$	[3 marks]
9	$y = 6x^{\frac{5}{2}} - 3x^{\frac{3}{2}} + 2x$	[3 marks]
10	$y = \frac{1}{x}$	[2 marks]
11	$y = \frac{5}{x^2} + 3x^4$	[3 marks]
12	$y = 4x^3 - \frac{6}{x} + 2\sqrt{x}$	[3 marks]
13	$y = \frac{3}{\sqrt{x}} + 5x^2$	[3 marks]
14	$y = 2x^{\frac{7}{3}} - 5x^{\frac{4}{3}} + x^{\frac{1}{3}}$	[4 marks]
15	$y = \frac{4}{x^3} - \frac{3}{x^2} + \frac{2}{x}$	[3 marks]
16	$y = \frac{x^4 + 3x^2 - 5}{x}$	[4 marks]
17	$y = \frac{2x^5 - 4x^3 + 6x}{x^2}$	[4 marks]
18	$y = \sqrt{x}\,(x^2 + 3x + 4)$	[4 marks]
19	$y = \frac{x^3 + 2x^2 - 4x + 7}{\sqrt{x}}$	[4 marks]
20	$y = \frac{3x^4 - 2x^2 + 5}{x^3}$	[4 marks]
21	$y = 4\sqrt{x^3} - \frac{3}{\sqrt{x}} + \frac{2}{x^2}$	[4 marks]
22	$y = \frac{2x^3 + 5x^2 - 3x + 1}{x^{\frac{3}{2}}}$	[5 marks]
23	$y = \frac{3x^4 - 2x^3 + 5x - 7}{\sqrt{x^3}}$	[5 marks]
24	$y = \sqrt{x}\,(2x^3 - 3x^2 + 4x - 5) + \frac{6}{x^2}$	[5 marks]
25	$y = \frac{2x^5 - 3x^3 + 4x^2 - 6}{x\sqrt{x}} + 5\sqrt{x^3} - \frac{4}{x^2}$	[6 marks]

Key reminders

- $\sqrt{x} = x^{\frac{1}{2}}$ $\quad \frac{1}{x} = x^{-1}$
- Differentiate each term separately.
- Give your answer in its simplest form.
- Check your working, especially with negative and fractional powers.



"Curiosity today, a deeper understanding tomorrow."

$f'(x) = nx^{n-1}$