Differentiation Rules: exam practice

10 questions · 27 marks · worked solutions and markschemes

Name _____ Date _____ Score / 27

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slai/differentiation-rules-exam-practice

1. **2 marks · Paper 1 style · calculator allowed**

Find $\frac{dy}{dx}$ for $y = 4x^3 - 5x^2 + 2x - 7$. **[2]**

2. **2 marks · Paper 1 style · calculator allowed**

Find the value of x at which the gradient of $y = x^2 - 6x + 1$ is 4. **[2]**

3. **2 marks · Paper 1 style · calculator allowed**

Find the gradient of the curve $y = x^3 - 3x$ at the point $(2, 2)$. **[2]**

4. 3 marks · Paper 1 style · calculator allowed

Let $f(x) = (x+3)(2x-1)$. Find $f'(x)$. **[3]**

5. 2 marks · Paper 1 style · calculator allowed

Let $y = \dfrac{x^3 + 2x}{x}$, for $x \neq 0$. Find $\dfrac{dy}{dx}$. **[2]**

6. 2 marks · Paper 1 style · calculator allowed

Let $f(x) = 5x^4 - \dfrac{3}{x}$. Find $f'(x)$. **[2]**

7. 3 marks · Paper 2 style · calculator allowed

The volume of a sphere of radius r cm is $V = \dfrac{4}{3}\pi r^3$.

Find $\dfrac{dV}{dr}$ when $r = 3$, and interpret your answer. **[3]**

8. 4 marks · Paper 1 style · calculator allowed

Let $f(x) = x^3 - 6x^2 + 5$.

Find the coordinates of the points where the gradient of f is -9. **[4]**

9. 4 marks · Paper 1 style · calculator allowed

Let $f(x) = ax^3 + bx$. It is given that $f'(1) = 8$ and $f'(2) = 35$.

Find the values of a and b. **[4]**

10. 3 marks · Paper 1 style · calculator allowed

Let $f(x) = \dfrac{6}{x^2}$.

(a) Write $f(x)$ in the form ax^n. **[1]**

(b) Find $f'(2)$. **[2]**

Answers and worked solutions

Question 1 — 2 marks

Answer: $12x^2 - 10x + 2$

$12x^2 - 10x + 2$ **A2**

Question 2 — 2 marks

Answer: 5

$2x - 6 = 4$ **(M1)**

$x = 5$ **A1**

Question 3 — 2 marks

Answer: 9

$3x^2 - 3$ at $x = 2$ **(M1)**

9 **A1**

Question 4 — 3 marks

Answer: $4x + 5$

$2x^2 + 5x - 3$ **(M1)(A1)**

$4x + 5$ **A1**

Question 5 — 2 marks

Answer: $2x$

$y = x^2 + 2$ **(M1)**

$2x$ **A1**

Question 6 — 2 marks

Answer: $20x^3 + \dfrac{3}{x^2}$

$20x^3$ **A1**

$+\dfrac{3}{x^2}$ **A1**

Question 7 — 3 marks

Answer: $113\ \text{cm}^3$ per cm

$\dfrac{dV}{dr} = 4\pi r^2$ **(M1)**

$113\ (36\pi)$ **A1**

the volume increases by about $113\ \text{cm}^3$ for each extra cm of radius at $r = 3$ **R1**

Question 8 — 4 marks

Answer: $(1, 0)$ and $(3, -22)$

$3x^2 - 12x = -9$ **M1**

$x^2 - 4x + 3 = 0$, $x = 1,\ 3$ **A1**

$(1, 0)$ **A1**

$(3, -22)$ **A1**

Question 9 — 4 marks

Answer: $a = 3,\ b = -1$

$f'(x) = 3ax^2 + b$ **A1**

$3a + b = 8$, $12a + b = 35$ **M1**

$a = 3$ **A1**

$b = -1$ **A1**

Question 10 — 3 marks

Answer: (a) $6x^{-2}$; (b) -1.5

(a)

$6x^{-2}$ **A1**

(b)

$f'(x) = -12x^{-3}$ **(M1)**

-1.5 **A1**

Every solution is also on ibmathrevision.com/slai/differentiation-rules-exam-practice
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