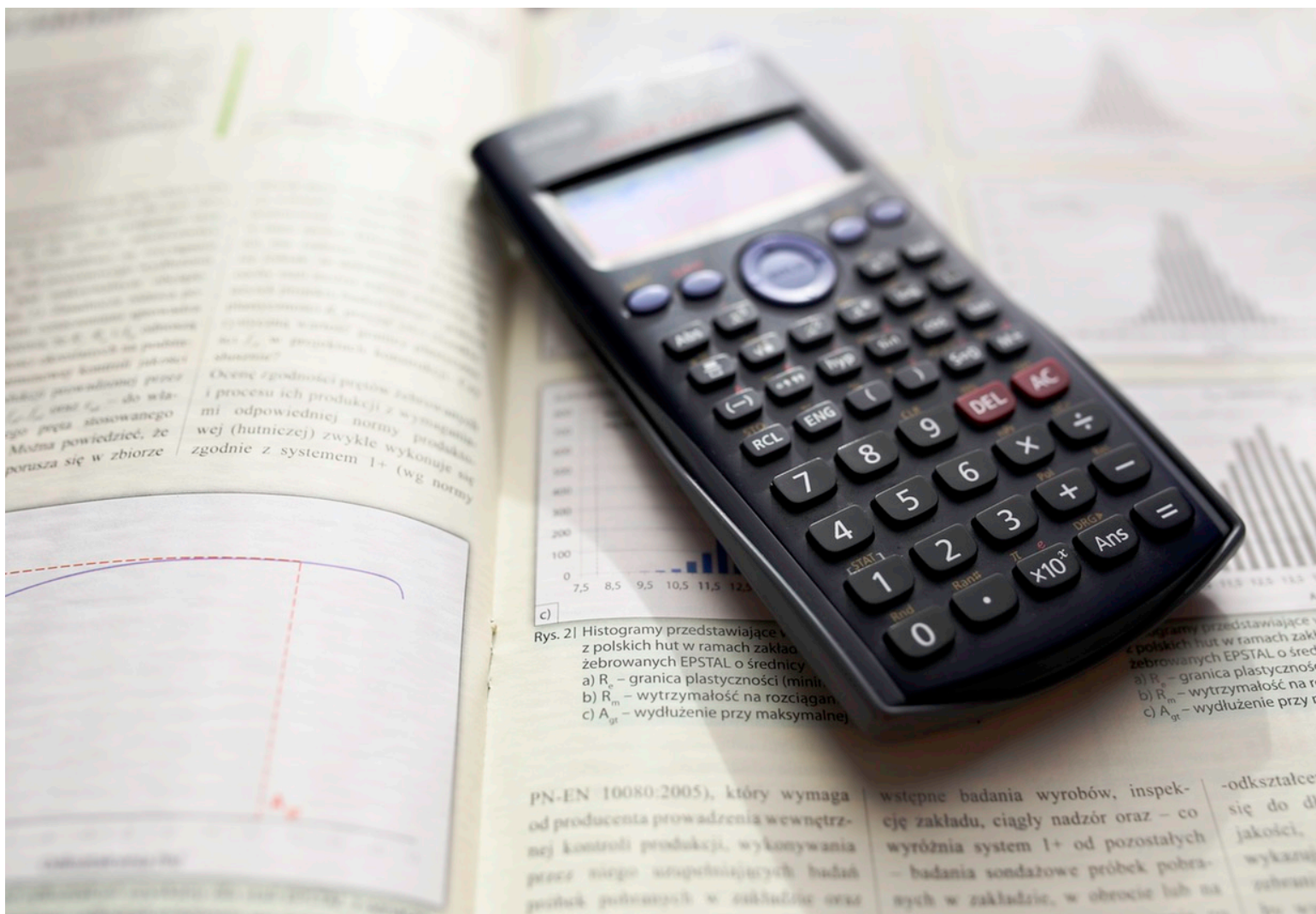


DIFFERENTIATION

FREE PRACTICE MINI TEST #1 MATHEMATICS METHODS – UNIT 3



ATAR Survival Guide: Answer Key

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Differentiation – Mini Test 1

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Section	Number of Questions Available	Number of Questions to Be Answered	Working Time (minutes)	Marks Available	Percentage of Paper
Non-Calculator	5	5	25	23	100%

Section 1: Non-Calculator

Question 1 (8 marks)

Differentiate:

i) $y = 5x^3$ (2 marks)

$$\frac{dy}{dx} = 3 * 5x^2$$

$$\frac{dy}{dx} = 15x^2 \checkmark \checkmark$$

ii) $y = (2x^2 + 5)(7x + 12)$ (2 marks)

$$\frac{dy}{dx} = (2x^2 + 5)(7) + (7x + 12)(4x)$$

$$\frac{dy}{dx} = 14x^2 + 35 + 28x^2 + 48x$$

$$\frac{dy}{dx} = 42x^2 + 48x + 35 \checkmark \checkmark$$

ii) $y = \frac{5x^3+2}{2x+7}$ (2 marks)

$$\frac{dy}{dx} = \frac{(2x+7)(15x^2) - (5x^3+2)(2)}{(2x+7)^2}$$

$$\frac{dy}{dx} = \frac{30x^3 + 105x^2 - (10x^3 + 4)}{(2x+7)^2}$$

$$\frac{dy}{dx} = \frac{20x^3 + 105x^2 - 4}{(2x+7)^2} \checkmark \checkmark$$

iv) $y = \frac{7x+5}{2x^3+3x}$ (2 marks)

$$\frac{dy}{dx} = \frac{(2x^3+3x)(7) - (7x+5)(6x^2+3)}{(2x^3+3x)^2}$$

$$\frac{dy}{dx} = \frac{14x^3 + 21x - (42x^3 + 21x + 30x^2 + 15)}{(2x^3+3x)^2}$$

$$\frac{dy}{dx} = \frac{-28x^3 - 30x^2 - 15}{(2x^3+3x)^2} \checkmark \checkmark$$

Question 2 (3 marks)

Find the equation of a line that passes through (5,25) and is situated on the curve $y = x^2$.

$$\frac{dy}{dx} = 2x$$

$$m = 2(5)$$

$$m = 10 \checkmark$$

$$y = mx + c$$

$$25 = 10(5) + c$$

$$25 = 50 + c$$

$$c = -25$$

$$y = 10x - 25 \checkmark \checkmark$$

Question 3 (4 marks)

Find $\frac{dy}{dx}$ where $y = 2u^2 + u^3$, $u = 2x^2 + 2$

$$\frac{dy}{dx} = \frac{dy}{du} * \frac{du}{dx}$$

$$\frac{dy}{dx} = (4u + 3u^2) * (4x)$$

$$\frac{dy}{dx} = 16xu + 12xu^2 \checkmark$$

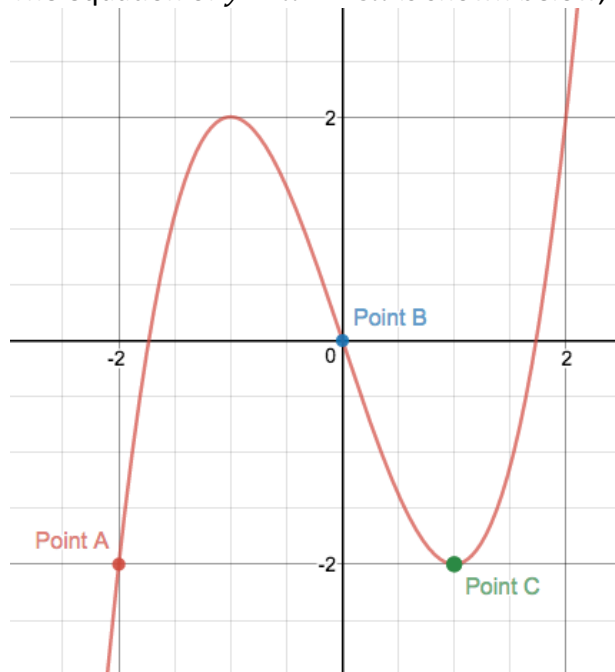
$$\frac{dy}{dx} = 16x(2x^2 + 2) + 12x(2x^2 + 2)^2 \checkmark$$

$$\frac{dy}{dx} = 32x^3 + 32x + 12x(4x^4 + 8x^2 + 4)$$

$$\frac{dy}{dx} = 48x^5 + 128x^3 + 80x \checkmark \checkmark$$

Question 4 (5 marks)

The equation of $y = x^3 - 3x$ is shown below, with the points A, B and C outlined.



Determine the gradient at the following points.

Point A (2 mark) $\frac{dy}{dx} = 3x^2 - 3$
 $m = 3(-2)^2 - 3$
 $m = 9$ ✓✓

Point B (2 mark) $\frac{dy}{dx} = 3x^2 - 3$
 $m = 3(0) - 3$
 $m = -3$ ✓✓

Point C (1 mark) 0 (given from graph) ✓

Question 5 (3 marks)

Differentiate $y = \sqrt{(10x + 3)}$ with respect to x .

$$\frac{dy}{dx} = \frac{1}{2}u^{-\frac{1}{2}}, u = 10x + 3$$

$$\frac{dy}{dx} = \frac{1}{2}u^{-\frac{1}{2}} * 10$$
 ✓

$$\frac{dy}{dx} = \frac{5}{u^{\frac{1}{2}}}$$

$$\frac{dy}{dx} = \frac{5}{(10x+3)^{\frac{1}{2}}}$$
 ✓✓

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