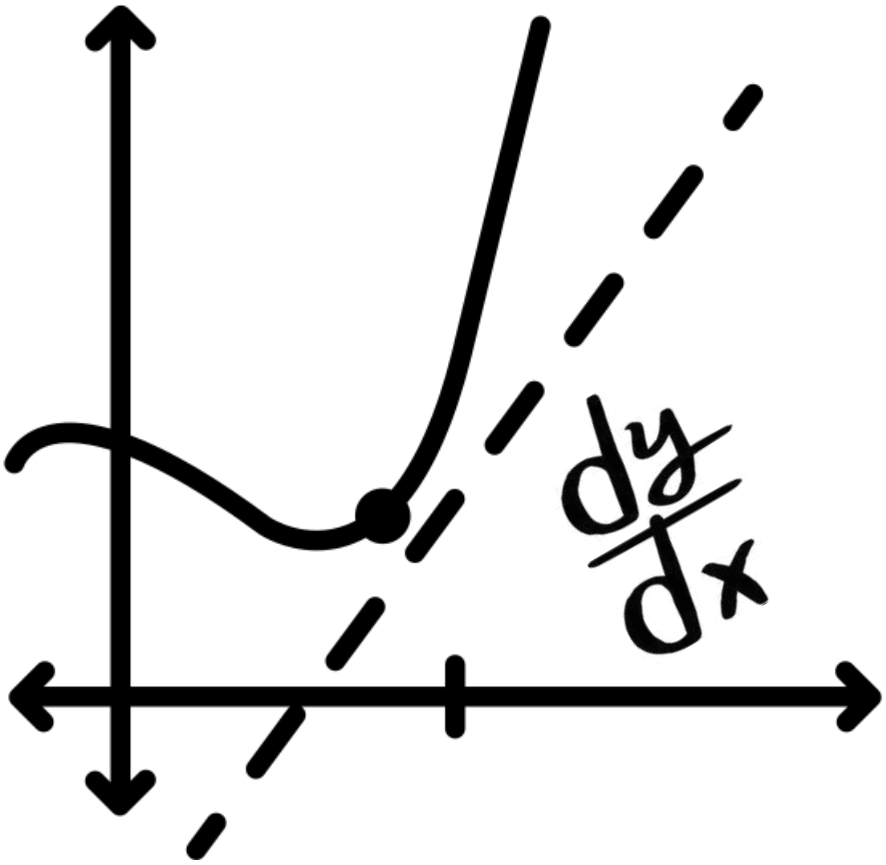
EDEXCEL IGCSE MATHEMATICS

UNIT 2 (MODULAR)

ALGEBRA – DIFFERENTIATION

QP & MS (2018 - 2025)



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EDEXCEL IGCSE MATHEMATICS MODULAR FOR MAY & OCT 2026

by Sir Muhammad Abdullah Shah

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1. Nov 2025 2H/Q22

Curve **C** has equation $y = x^3 - 16x + 7$

At two points on **C**, the gradient is 11
The tangents to **C** at these two points have equations of the form $y = ax + b$

Work out the two possible values of b
Show clear algebraic working.

(Total for Question 22 is 6 marks)

2. June 2025 2H/Q17

$y = 4x^3 + 5x^2 + 2x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

(b) Find the coordinates of the turning points on the graph with equation $y = 4x^3 + 5x^2 + 2x$
Show clear algebraic working.

.....

(4)

(Total for Question 17 is 6 marks)

3. June 2025 2HR/Q22

The diagram shows a solid cuboid.

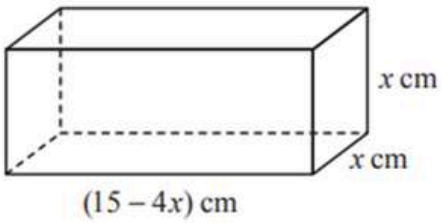


Diagram **NOT** accurately drawn

The volume of the cuboid is V cm^3

Find the maximum value of V

.....

(Total for Question 22 is 5 marks)

4. Nov 2023 2H/Q18

A particle is moving along a straight line that passes through the fixed point O
The displacement, s metres, of the particle from O at time t seconds is given by

$$s = 2t^3 - 5t^2 + 6t - 5$$

Find the value of t when the acceleration of the particle is 5 m/s²

$t =$ .....

(Total for Question 18 is 4 marks)

5. Jan 2022 2H/Q24

A particle P moves along a straight line that passes through the fixed point O

The displacement, x metres, of P from O at time t seconds, where $t \geqslant 0$, is given by

$$x = 4t^3 - 27t + 8$$

The direction of motion of P reverses when P is at the point A on the line.

The acceleration of P at the instant when P is at A is a m/s^2

Find the value of a

$a =$ .....

(Total for Question 24 is 5 marks)

6. Oct 2021 2H/Q21

The curve **C** has equation $y = f(x)$ where $f(x) = 9 - 3(x + 2)^2$
The point A is the maximum point on **C**.

(a) Write down the coordinates of A.

(.....,.....)
(1)

The curve **C** is transformed to the curve **S** by a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

(b) Find an equation for the curve **S**.

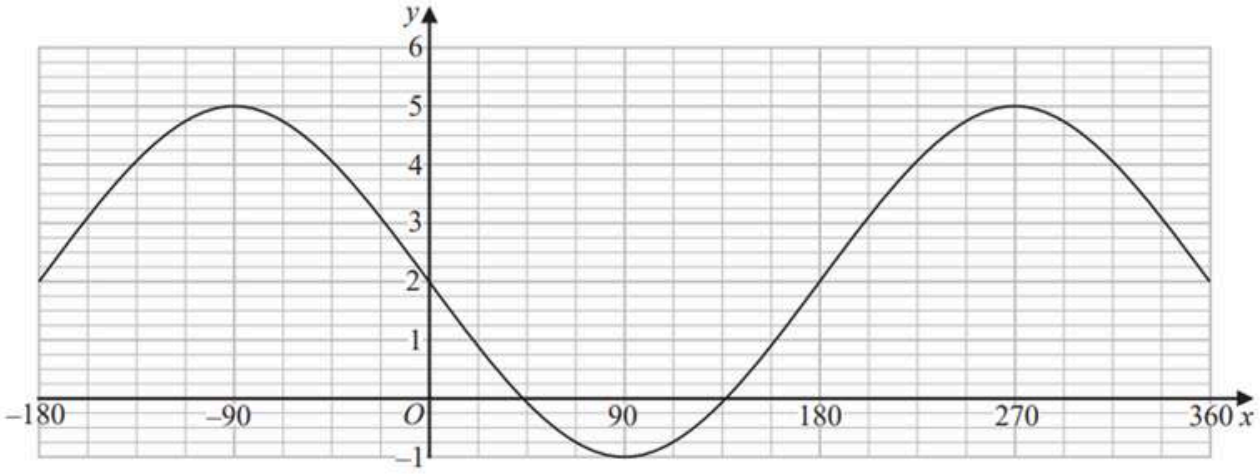
.....
(1)

The curve **C** is transformed to the curve **T**.
The curve **T** has equation $y = 3(x + 2)^2 - 9$

(c) Describe fully the transformation that maps curve **C** onto curve **T**.

.....
(1)

The graph of $y = a\cos(x - b)° + c$ for $-180 \leqslant x \leqslant 360$ is drawn on the grid below.



(d) Find the value of a, the value of b and the value of c.

$a =$ .....

$b =$ .....

$c =$ .....

(3)

(Total for Question 21 is 6 marks)

7. May 2021 2H/Q21

The point A is the only stationary point on the curve with equation $y = kx^2 + \frac{16}{x}$ where k is a constant.

Given that the coordinates of A are $\left(\frac{2}{3}, a\right)$

find the value of a.
Show your working clearly.

$a =$ .....

(Total for Question 21 is 5 marks)

8. Jan 2021 2H/Q19

A particle P is moving along a straight line.
The fixed point O lies on this line.

At time t seconds where $t \geqslant 0$, the displacement, s metres, of P from O is given by

$$s = t^3 + 5t^2 - 8t + 10$$

Find the displacement of P from O when P is instantaneously at rest.

Give your answer in the form $\frac{a}{b}$ where a and b are integers.

..... metres

(Total for Question 19 is 5 marks)

9. June 2019 2H/Q18

The diagram shows a solid cuboid.

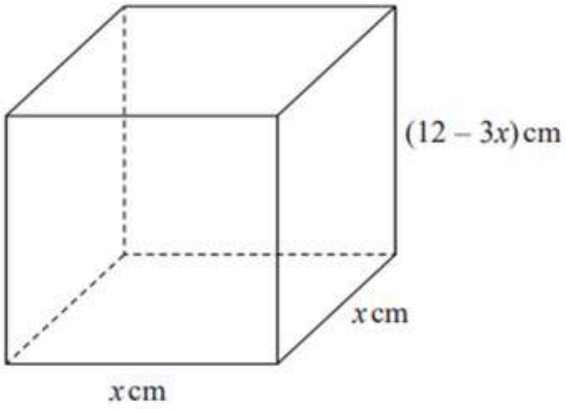


Diagram **NOT** accurately drawn

The total surface area of the cuboid is A cm^2

Find the maximum value of A.

(Total for Question 18 is 5 marks)

10. June 2018 2H/Q17

$$y = x^3 - 2x^2 - 15x + 5$$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

C is the curve with equation $y = x^3 - 2x^2 - 15x + 5$

(b) Work out the range of values of x for which **C** has a negative gradient.

.....

(4)

(Total for Question 17 is 6 marks)

11. Sample 2018 2H/Q25

A particle moves along a straight line.
The fixed point O lies on this line.
The displacement of the particle from O at time t seconds, $t \geqslant 0$, is s metres, where

$$s = t^3 - 5t^2 - 8t + 3$$

Find the value of t for which the particle is instantaneously at rest.

$t =$ .....

(Total for Question 25 is 4 marks)

MARKING SCHEME

1. Nov 2025 2H/Q22

22	$\left(\frac{dy}{dx}=\right)3\times x^2-16\left(=3x^2-16\right)$		6	B2 for $3\times x^2-16$ or $3x^2-16$ (with no other terms) (B1 for one term, ie $3\times x^2$ or $3x^2$ or -16)
	$3x^2-16=11$ oe eg $3x^2-27=0$ (allow one of $x=3$ or $x=-3$)			M1 ft dep on B1 Derivative must be a two term **quadratic** in the form $3x^2-a=11$ oe where $a\neq 0$ or $bx^2-16=11$ oe where $b\neq 0$ (a and b are constants) Allow $3x^2-16+7=11$ oe **NB** $3x^2-16x=11$ is M0
	$(y=)("3")^3-16("3")+7(=-14)$ **or** $(y=)("-3")^3-16("-3")+7(=28)$			M1 dep on previous M1 **and** for a correct rearrangement for x
	$"-14"=11("3")+b$ or $y-"-14"=11(x-"3")$ or $\frac{y-"-14"}{x-"3"}=11$ oe **or** $"28"=11("-3")+b$ or $y-"28"=11(x-"-3")$ or $\frac{y-"28"}{x-"-3"}=11$ oe			M1 dep on previous M1
	Working required	–47 and 61		A1 dep on B2M1 Answer of –47 or 61 award 5 marks dep on B2M1
				Total 6 marks

2. June 2025 2H/Q17

Question	Working	Answer	Mark	Notes
17(a)	Two of $12x^2+10x+2$		2	M1 for differentiating 2 or 3 terms correctly
		$12x^2+10x+2$		A1 for all 3 terms correct
(b)	$(3x+1)(4x+2)(=0)$ or $(6x+2)(2x+1)(=0)$ or $2(3x+1)(2x+1)(=0)$ or $(3x+1)(2x+1)(=0)$ $\frac{-10\pm\sqrt{10^2-4\times12\times2}}{2\times12}$ or $\frac{-5\pm\sqrt{5^2-4\times6\times1}}{2\times6}$ or $12\left[\left(x+\frac{10}{24}\right)^2-\left(\frac{10}{24}\right)^2\right]+2(=0)$ oe or $6\left[\left(x+\frac{5}{12}\right)^2-\left(\frac{5}{12}\right)^2\right]+1(=0)$ oe		4	M1 ft dep on M1 for a correct method to solve their **3 term quadratic** equation (with at least 2 correct coefficients) using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{-10\pm\sqrt{100-96}}{24}$) Derivative must be a **3 term quadratic** for this M mark NB Can be implied by answers of $(x=)-\frac{1}{2}$ **and** $(x=)-\frac{1}{3}$
		$-\frac{1}{2}, -\frac{1}{3}$		A1 oe dep on previous M1 Allow –0.33(333) or $-0.\dot{3}$ for correct x values
	$(y=)4\times\left(-\frac{1}{2}\right)^3+5\left(-\frac{1}{2}\right)^2+2\left(-\frac{1}{2}\right)\left(=-\frac{1}{4}\right)$ or $(y=)4\times\left(-\frac{1}{3}\right)^3+5\left(-\frac{1}{3}\right)^2+2\left(-\frac{1}{3}\right)\left(=-\frac{7}{27}\right)$			M1 ft dep on previous M1for substituting at least one x value into y NB Can be implied by one correct value of y
	Working required	$\left(-\frac{1}{2}, -\frac{1}{4}\right)$ $\left(-\frac{1}{3}, -\frac{7}{27}\right)$		A1 oe dep on M1 for correct coordinates $(-0.5, -0.25)$, $(-0.33, -0.25(9...))$
				Total 6 marks

3. June 2025 2HR/Q22

22	$(V=)\ x(x)(15-4x)\ \ (=15x^2-4x^3)$		5	M1	for a correct expression for the volume (condone missing $V=\ldots$)
	$\left(\frac{dV}{dx}=\right)\ 30x-12x^2$			M1ft	ft dep on a V of the form ax^3+bx^2 where $a, b \neq 0$ for a two-term derivative with at least one term correct for their V eg $15(2)x$ **or** $30x$ **or** $-3(4)x^2$ **or** $-12x^2$
	$30x-12x^2=0 \Rightarrow x=\ldots$ **or** $(x=)\ 2.5$ oe			M1ft	dep on previous M mark for equating their 2-term first derivative to 0 and solving to get a value of x (the value of x obtained must be greater than 0 and must not be where their second derivative is equal to 0) **or** the correct value of x
	$(V=)$ "2.5" × "2.5" × (15 – 4 × "2.5") **or** $(V=)\ 15(\text{"2.5"})^2-4(\text{"2.5"})^3$			M1	dep on M3 for a full and correct substitution of their value of x
	Correct answer only scores full marks (unless from obviously incorrect working)	31.25		A1	oe eg $\frac{125}{4}$ ignore any units on the answer line
					Total 5 marks

4. Nov 2023 2H/Q18

Question	Working	Answer	Mark	Notes
18	$(\frac{ds}{dt}=)\ 6t^2-10t+6$		4	M1 at least 2 terms correct
	$(\frac{dv}{dt}=)12t-10$			M1ft ft from a 3 term quadratic
	"$12t-10$" $=5$			M1ft ft dep on previous M1 awarded
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	1.25		A1oe
				Total 4 marks

5. Jan 2022 2H/Q24

24	$(v=)\ 12t^2-27\ (=0)$		5	M1	Correct differentiation
	$t^2=\frac{27}{12}\ \ (=\frac{9}{4})$ oe **or** $(3)(2t+3)(2t-3)\ (=0)$			M1	dep M1 first stage to solve $v=0$ by rearranging, factorising, quadratic formula, or completing the square
	$\sqrt{\frac{9}{4}}$ oe $(=\frac{3}{2})$ **or** $\pm\sqrt{\frac{9}{4}}$ oe $(=\pm\frac{3}{2})$			A1	Correct value of t (allow $\pm$)
	$(a=)\ 24t$			M1	dep 1st M1 for differentiating v
		36		A1	correct answer
					Total 5 marks

6. Oct 2021 2H/Q21

24	$(v=)\ 12t^2-27\ (=0)$		5	M1	Correct differentiation
	$t^2=\frac{27}{12}\ \ (=\frac{9}{4})$ oe **or** $(3)(2t+3)(2t-3)\ (=0)$			M1	dep M1 first stage to solve $v=0$ by rearranging, factorising, quadratic formula, or completing the square
	$\sqrt{\frac{9}{4}}$ oe $(=\frac{3}{2})$ **or** $\pm\sqrt{\frac{9}{4}}$ oe $(=\pm\frac{3}{2})$			A1	Correct value of t (allow $\pm$)
	$(a=)\ 24t$			M1	dep 1st M1 for differentiating v
		36		A1	correct answer
					Total 5 marks

7. May 2021 2H/Q21

Question	Working	Answer	Mark	Notes	
21	$\left[\frac{dy}{dx}=\right]2\times kx-16x^{-2}$ **or** $2kx-\frac{16}{x^2}$ oe		5	M2	for both terms differentiated correctly
				(M1)	for one term differentiated correctly
	"$2kx-16x^{-2}$" $=0$ oe			M1	ft dep on M1
	eg $\frac{8}{27}k=8$ or $\frac{4}{3}k=36$ or $k=27$ oe			M1	(not ft) for substituting $x=\frac{2}{3}$ into their correct equation for k and getting as far as one step from the value of k or the correct value of k
	Working must be seen	36		A1	dep on M4
					Total 5 marks

8. Jan 2021 2H/Q19

19	$(v=)\ 3t^2+10t-8$		5	M1	For at least 2 terms differentiated correctly
	$3t^2+10t-8=0$			M1	Their $v=0$ dep on M1 could be implied by correct values
	$(3t-2)(t+4)\ (=0)$ $(t=)\ \frac{2}{3}$ or $(t=)-4$			M1	dep on M1 for correct values for t or for $t=\frac{2}{3}$ or correct method to solve their 3 term quadratic equation: If factorising, allow brackets which when expanded give 2 out of 3 terms correct (If using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{-10\pm\sqrt{100+96}}{6}$ oe $3(t+\frac{5}{3})^2-\frac{48}{3}=0$)
	$(s=)\left(\frac{2}{3}\right)^3+5\times\left(\frac{2}{3}\right)^2-8\times\frac{2}{3}+10$			M1	For $\frac{2}{3}$ (only) substituted into formula for s or for selecting the value from this substitution or for an answer of 7.185…
		$\frac{194}{27}$		A1	oe but numerator and denominator must be integers.
					Total 5 marks

9. June 2019 2H/Q18

18		x^2 oe **or** $x(12 - 3x)$ oe				M1 for finding an expression for the area of **one** face
		$x^2 + x^2 + 48x - 12x^2$ (= $48x - 10x^2$)				M1 for a complete expression for A (**6** sides) with brackets expanded
		'48 – 20x' = 0	'−10'[(x – '2.4')^2 – '2.4'^{2}] oe			M1 for differentiating a correct expression for A (allow 1 error) **and** equating to zero **or** completing the square
		(x = 2.4) 48 × '2.4' – 10 × '2.4'^{2}	'−10' × – '2.4'^{2} or '−10' × – '5.76'			M1 ft if previous M1 awarded for isolating x and substituting into A **or** finding max value of A from completing the square
				57.6	5	A1 accept 58 from correct working
						Total 5 marks

10. June 2018 2H/Q17

Question	Working	Answer	Mark	Notes
17 (a)		$3x^2-4x-15$	2	B2 Award B1 for any 2 or 3 of the 4 terms differentiated correctly.
(b)	$3x^2 - 4x - 15 < 0$ (or = 0)		4	M1 ft from (a) ie "their (a)" = 0 (or < 0)
	$(3x + 5)(x - 3)(< 0)$ **or** $\frac{-(-4)\pm\sqrt{(-4)^2-4\times3\times(-15)}}{2\times3}$			M1 ft from "their (a)" (=0) for 3 term quadratic, for correct factorisation **or** correct use of quadratic formula to find the two critical values, allow 1 sign error. [−(−4) could be 4 and $(-4)^2$ could be 4^2](condone missing brackets)
	$-\frac{5}{3}, 3$			M1 Both critical values correct Accept -1.66... rounded or truncated to 3SF.
		$-\frac{5}{3} < x < 3$		A1oe Inequality signs needed Allow $x > -\frac{5}{3}$, $x < 3$
				Total 6 marks

11. Sample 2018 2H/Q25

25	$(v =) 3t^2 - 5\times2t - 8$ $3t^2 - 10t - 8 = 0$ $(3t + 2)(t - 4) = 0$	4	4	AO1	M1 A1 M1 A1	for 2 out of 3 terms differentiated correctly correct equation for method to solve quadratic $t = 4$ only