



Edexcel AQA AS Mathematics

7356/1 - Pure Mathematics and Mechanics

Thursday 15 May 2025

Questions and Fully Worked Model Solutions

This booklet places the **question and the solution together**. The mathematics is set out using proper fractions, powers, roots and exact notation, with extra written explanation so that a student can see *why* each step is being taken.

Solutions have been checked against the Pearson Edexcel Summer 2025 mark scheme. The aim is a clear **full-mark model response**, not merely a list of final answers.

Contents

Question 1	2
Question 2	3
Question 3	4
Question 4	5
Question 5	6
Question 6	7
Question 7	8
Question 8	9
Question 9	10
Question 10	11
Question 11	12
Question 12	13
Question 13	14
Question 14	15
Question 15	16
Question 16	17
Question 17	18
Question 18	19
Question 19	20
Question 20	21
Question 21	22

Question 1

Question 1

Identify the expression equivalent to $\tan x$.

Model solution

Use the defining quotient identity.

$$\tan x = \frac{\sin x}{\cos x}.$$

$$\frac{\sin x}{\cos x}$$

(1)

www.mathswithmatt.co.uk

Question 2

Question 2

Find $\log_b(1/b^2)$.

Model solution

Rewrite the reciprocal as a power of the base.

$$\log_b(1/b^2) = \log_b(b^{-2}) = -2.$$

−2

(1)

www.mathswithmatt.co.uk

Question 3

Question 3

$p(x) = 2x^3 - ax^2 + 6x + 2a$, and $(x - 2)$ is a factor. Find a using the factor theorem.

Model solution

The factor theorem makes $p(2) = 0$.

$$0 = 2(2)^3 - a(2)^2 + 6(2) + 2a = 28 - 2a.$$

$$a = 14.$$

$$a = 14$$

(3)

www.mathswithmatt.co.uk

Question 4

Question 4

Solve $2 \tan 3\theta - 3 = 0$ for $0^\circ \leq \theta \leq 180^\circ$. Give answers to the nearest degree.

Model solution

Isolate the tangent. The given range means $0^\circ \leq 3\theta \leq 540^\circ$, so include every tangent solution in this interval.

$$\tan 3\theta = \frac{3}{2}, \quad 3\theta = 56.31^\circ + 180^\circ n.$$

$$3\theta = 56.31^\circ, 236.31^\circ, 416.31^\circ.$$

$$\theta = 18.77^\circ, 78.77^\circ, 138.77^\circ.$$

$$19^\circ, 79^\circ, 139^\circ$$

(3)

Question 5

Question 5

Jayven claims that $a > b$ implies $a/b > 1$ for real a, b . Disprove this using a counterexample.

Model solution

One case where the condition holds but the conclusion fails disproves the claim.

$$a = 1, \quad b = -1: \quad 1 > -1 \quad \text{but} \quad \frac{a}{b} = -1 < 1.$$

$a = 1, b = -1$ is a counterexample.

(2)

www.mathswithmatt.co.uk

Question 6

Question 6

Given $p = \log_2 x$, $q = \log_2 y$: (a) express $\log_2(x^2/y)$; (b) express $\log_2(16x^3\sqrt{y})$ in terms of p , q .

Model solution

(a) Apply the quotient and power laws of logarithms.

$$\log_2\left(\frac{x^2}{y}\right) = 2\log_2 x - \log_2 y = 2p - q.$$

$$2p - q$$

(b) Split the product, using $\sqrt{y} = y^{1/2}$.

$$\log_2(16x^3\sqrt{y}) = 4 + 3\log_2 x + \frac{1}{2}\log_2 y = 4 + 3p + \frac{1}{2}q.$$

$$4 + 3p + \frac{1}{2}q$$

(5)

Question 7

Question 7

A circle is $(x - a)^2 + (y - b)^2 = 49$. (a) State its radius. (b) It crosses the x -axis twice: find the range of b .

Model solution

(a) Compare with the standard circle equation, for which the right side is r^2 .

$$r = \sqrt{49} = 7.$$

7

(b) Two intersections require the centre's distance from the x -axis to be less than the radius.

$$|b| < 7 \Rightarrow -7 < b < 7.$$

$$-7 < b < 7$$

(3)

Question 8

Question 8

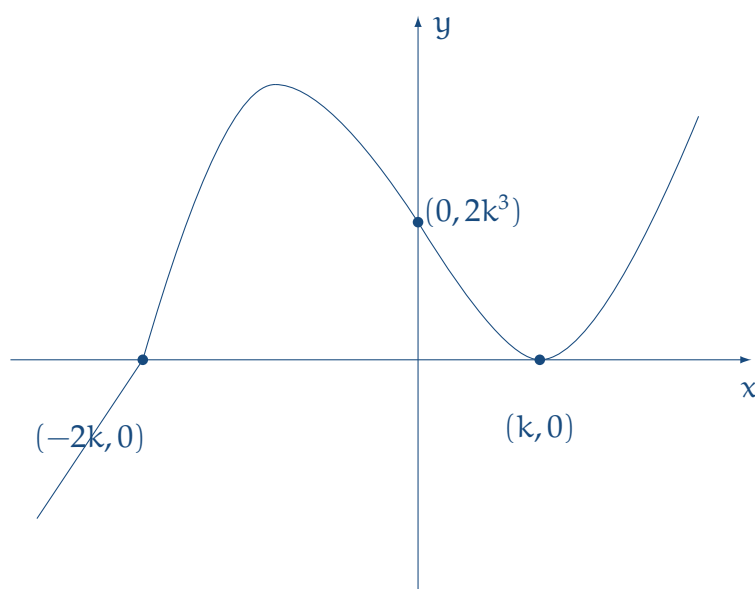
Sketch $y = (x - k)^2(x + 2k)$, where $k > 0$, labelling all axis intercepts.

Model solution

The factorised form identifies the roots. The repeated factor means the curve touches the axis there; its positive x^3 coefficient makes it a rising cubic.

$$y = 0 \Rightarrow x = -2k \text{ or } x = k \text{ (double root)}.$$

$$x = 0 \Rightarrow y = (-k)^2(2k) = 2k^3.$$



The rising cubic crosses the x -axis at $(-2k, 0)$, has two turning points, and touches the axis at $(k, 0)$.

Intercepts $(-2k, 0)$, $(k, 0)$ and $(0, 2k^3)$; $(k, 0)$ is a touching point.

(4)

Question 9

Question 9

(a) Find the first three terms of $(1 - 5x)^7$. (b) The coefficient of x^2 in $(3 + kx)(1 - 5x)^7$ is 1477. Find k .

Model solution

(a) Use the binomial expansion through x^2 .

$$(1 - 5x)^7 = 1 + 7(-5x) + \binom{7}{2}(-5x)^2 + \dots = 1 - 35x + 525x^2 + \dots$$

$$1 - 35x + 525x^2$$

(b) An x^2 term comes from $3(525x^2)$ or $(kx)(-35x)$.

$$1575 - 35k = 1477 \Rightarrow 35k = 98 \Rightarrow k = \frac{14}{5}$$

$$k = \frac{14}{5}$$

(6)

Question 10

Question 10

The curve is $y = e^{3x}$. Its tangent at P is parallel to $x - 9y = 23$. Find the x-coordinate of P.

Model solution

Parallel lines have equal gradients. Rearrange the line, then differentiate the curve to obtain its tangent gradient.

$$x - 9y = 23 \Rightarrow y = \frac{1}{9}x - \frac{23}{9}, \quad \frac{dy}{dx} = 3e^{3x}.$$

$$3e^{3x} = \frac{1}{9} \Rightarrow e^{3x} = \frac{1}{27}.$$

$$3x = \ln(1/27) = -3\ln 3 \Rightarrow x = -\ln 3.$$

$$x = -\ln 3$$

(5)

Question 11

Question 11

For $y = x(x - 2)(x + 4)$: (a) expand; (b) show $\int_{-4}^2 x(x - 2)(x + 4) \, dx = 36$; (c) explain why this is not total area and find the total area.

Model solution

(a) Expand the brackets before multiplying by x .

$$x(x - 2)(x + 4) = x(x^2 + 2x - 8) = x^3 + 2x^2 - 8x.$$

$$x^3 + 2x^2 - 8x$$

(b) Integrate term by term, then use upper minus lower limits.

$$\begin{aligned} \int_{-4}^2 (x^3 + 2x^2 - 8x) \, dx &= \left[\frac{x^4}{4} + \frac{2x^3}{3} - 4x^2 \right]_{-4}^2 \\ &= \left(-\frac{20}{3} \right) - \left(-\frac{128}{3} \right) = 36. \end{aligned}$$

$$\int_{-4}^2 x(x - 2)(x + 4) \, dx = 36$$

(c)(i) Definite integration gives signed area. The curve has portions above and below the x -axis, so the below-axis part has been subtracted.

It is not total area because part is below the x -axis.

(c)(ii) Split at the root $x = 0$ and add the magnitudes of the two areas.

$$\frac{128}{3} + \frac{20}{3} = \frac{148}{3}.$$

$$\frac{148}{3} \text{ square units}$$

(8)

Question 12

Question 12

(a) $\binom{40}{18} = 40!/(18!p!)$: find p . (b) Show $\binom{40}{18}/\binom{40}{17} = 23/q$ and find q .

Model solution

(a) The second factorial is $(40 - 18)!$.

$$p = 22.$$

$$p = 22$$

(b) Substitute factorial definitions and cancel common factors.

$$\frac{\binom{40}{18}}{\binom{40}{17}} = \frac{40!}{18!22!} \div \frac{40!}{17!23!} = \frac{17!23!}{18!22!} = \frac{23}{18}.$$

$$q = 18.$$

$$q = 18$$

(3)

Question 13

Question 13

Points are $P = Ae^{kt}$, where t is completion time. (a) Interpret A . (b) Show $\ln P = \ln A + kt$. (c) A plot of $\ln P$ against t has gradient -0.08 and intercept 5.30 : find A, k . (d) Find t when $P = 20$.

Model solution

(a) At the start, $t = 0$.

$$P = Ae^0 = A.$$

A is the number of points available at the start of the level.

(b) Taking logarithms linearises the exponential model.

$$\ln P = \ln(Ae^{kt}) = \ln A + \ln(e^{kt}) = \ln A + kt.$$

$$\ln P = \ln A + kt$$

(c) Compare this with a straight line: gradient $= k$ and intercept $= \ln A$.

$$k = -0.08, \quad \ln A = 5.30 \Rightarrow A = e^{5.30} = 200.336 \dots$$

$$A \approx 200, \quad k = -0.08$$

(d) Substitute the parameters and solve the exponential equation.

$$20 = 200e^{-0.08t} \Rightarrow 0.1 = e^{-0.08t} \Rightarrow t = \frac{\ln(0.1)}{-0.08} = 28.782 \dots$$

$$29 \text{ s}$$

(9)

Question 14

Question 14

A 2 kg particle on a smooth horizontal surface has a single horizontal force of 5 N. Find its acceleration.

Model solution

No friction acts horizontally, so apply $F = ma$.

$$a = \frac{5}{2} = 2.5 \text{ m s}^{-2}.$$

$$2.5 \text{ m s}^{-2}$$

(1)

www.mathswithmatt.co.uk

Question 15

Question 15

$\mathbf{F}_1 = (-2\mathbf{i} + 4\mathbf{j})$, $\mathbf{F}_2 = (-3\mathbf{i} + 6\mathbf{j})$, $\mathbf{F}_3 = (-6\mathbf{i} + 9\mathbf{j})$. Identify the parallel pair.

Model solution

Parallel vectors are scalar multiples.

$$\mathbf{F}_2 = \frac{3}{2}\mathbf{F}_1, \quad \frac{-6}{-2} = 3 \neq \frac{9}{4}.$$

$\mathbf{F}_1$ and $\mathbf{F}_2$ are parallel.

(1)

www.mathswithmatt.co.uk

Question 16

Question 16

A displacement–time graph shows a car starting from rest and travelling 12 m in 5 s. (a) Find its speed. (b) Draw a more realistic graph.

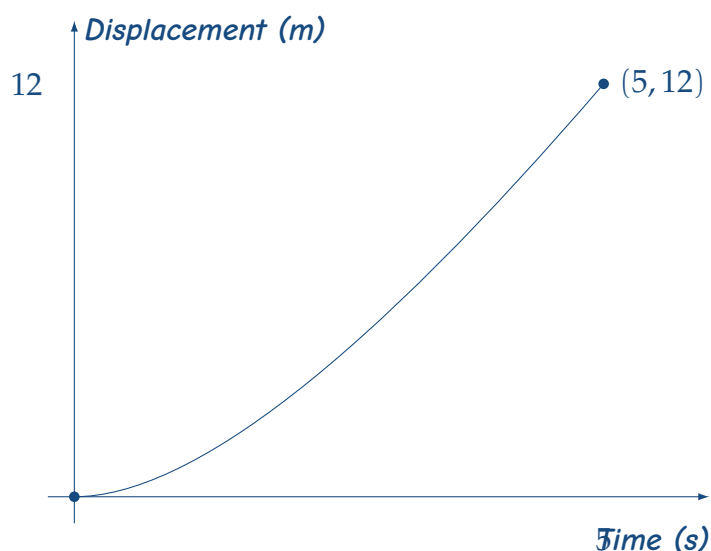
Model solution

(a) Gradient of a displacement–time graph is speed.

$$\frac{12}{5} = 2.4 \text{ m s}^{-1}.$$

$$2.4 \text{ m s}^{-1}$$

(b) Starting from rest requires zero initial gradient. The graph should curve upwards as the speed increases and reach (5, 12).



A curve convex at the origin, initially horizontal, passing through (5, 12).

(2)

Question 17

Question 17

Use $g = 9.8 \text{ m s}^{-2}$. A 60 kg man in a lift accelerates upwards at 1.2 m s^{-2} . Find floor reaction R .

Model solution

Take upwards as positive: reaction is upwards and weight is downwards.

$$R - 60(9.8) = 60(1.2) \Rightarrow R = 660.$$

$$R = 660 \text{ N}$$

(2)

www.mathswithmatt.co.uk

Question 18

Question 18

Use $g = 10 \text{ m s}^{-2}$. A ball is thrown upwards at 12 m s^{-1} from 1.8 m above ground. Find greatest height h .

Model solution

At greatest height $v = 0$, so $v^2 = u^2 + 2as$ finds the rise without needing time. Take upwards positive, $a = -10$.

$$0 = 12^2 + 2(-10)s \Rightarrow s = 7.2 \text{ m.}$$

$$h = 1.8 + 7.2 = 9 \text{ m.}$$

$$h = 9 \text{ m}$$

(3)

Question 19

Question 19

$\mathbf{F} = \begin{pmatrix} p \\ -0.5 \end{pmatrix}$ N has magnitude 1.3 N. Find p .

Model solution

Square the vector magnitude equation to use Pythagoras without a square root.

$$p^2 + (-0.5)^2 = 1.3^2 \Rightarrow p^2 = 1.44.$$

$$p = \pm 1.2.$$

$$p = 1.2 \text{ or } p = -1.2$$

(3)

Question 20

Question 20

$v = 1.8 + 3.8t - 0.25t^2 \text{ m s}^{-1}$. (a) State initial speed. (b)(i) Find acceleration; (ii) find and justify maximum speed. (c) Recorded maximum is 12.4 m s^{-1} : evaluate model.

Model solution

(a) Initial means $t = 0$.

$$v(0) = 1.8 \text{ m s}^{-1}.$$

$$1.8 \text{ m s}^{-1}$$

(b)(i) Acceleration is dv/dt .

$$a = 3.8 - 0.5t.$$

$$a = 3.8 - 0.5t \text{ m s}^{-2}$$

(b)(ii) A maximum speed has zero acceleration. The negative quadratic coefficient confirms the stationary point is a maximum.

$$3.8 - 0.5t = 0 \Rightarrow t = 7.6.$$

$$v(7.6) = 1.8 + 3.8(7.6) - 0.25(7.6)^2 = 16.24 \text{ m s}^{-1}.$$

$$16.24 \text{ m s}^{-1} \text{ at } 7.6 \text{ s}$$

(c) The model predicts 16.24, which exceeds the recorded 12.4 by 3.84 m s^{-1} .

The model significantly overestimates the maximum speed, so is not accurate.

(8)

Question 21

Question 21

Buckets A, B each have mass 0.5 kg and are linked by a light inextensible rope over a smooth pulley. A 3 kg brick is put in A, which moves down. (a) Find a, T in terms of g . (b) Give a particle-model limitation.

Model solution

(a) *Bucket A plus brick has mass 3.5 kg. Take downwards positive for A and upwards positive for B; the inextensible rope gives equal acceleration magnitudes.*

$$3.5g - T = 3.5a \quad \text{and} \quad T - 0.5g = 0.5a.$$

Add the equations to eliminate tension, then substitute back.

$$3g = 4a \Rightarrow a = \frac{3}{4}g.$$

$$T - 0.5g = 0.5 \left(\frac{3}{4}g \right) \Rightarrow T = \frac{7}{8}g.$$

$$a = \frac{3}{4}g \text{ m s}^{-2}, \quad T = \frac{7}{8}g \text{ N}$$

(b) *A particle has no dimensions.*

The model ignores the buckets' size and shape, which is unrealistic.

(7)