

GCSE MATHEMATICS (9-1) — EXAM PRACTICE WORKBOOK

Grade 8 & 9 Mathematics — Practice Questions

(Higher Tier)

Higher Tier Exam Practice, Calculator Tags, 2 Mixed Review Papers & Full Answer Key

- 6 Edexcel Higher Exam-Style Questions per topic with mark allocations
- Calculator & Non-Calculator Badges on every single question
- 2 Interleaved Mixed Review Sets (Paper 1 & Paper 2/3 method selection)
- Structured Working Spaces & Topic-Linked Answer Key Appendix

Student Name: _____

Class / Teacher: _____

Target Grade: _____



SCAN FOR ONLINE PRACTICE & WORKED SOLUTIONS

BreakingDownMaths.com

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Click any topic to jump straight there. Complete both Mixed Review Sets before checking the Answer Key Appendix.

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Completing the Square

EDEXCEL GCSE EXAM PRACTICE

Total: 17 marks

Completing the Square — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 Non-Calculator

(2 marks)

Write $x^2 + 8x + 23$ in the form $(x + a)^2 + b$

WORKING OUT SPACE

Answer:

Question 2 Non-Calculator

(3 marks)

Write $3x^2 + 30x + 79$ in the form $a(x + b)^2 + c$

WORKING OUT SPACE

Answer:

Question 3 Non-Calculator

(3 marks)

By completing the square, solve $x^2 - 16x + 38 = 0$.

Give your answers in surd form.

WORKING OUT SPACE

Answer:

Question 4 Calculator

(3 marks)

By completing the square, solve $5x^2 + 40x - 40 = 0$.

Give your answers to 2 decimal places.

WORKING OUT SPACE

Answer:

Question 5 **Non-Calculator****(3 marks)**

By completing the square, find the coordinates of the minimum point of the curve $y = 2x^2 - 12x + 11$.

WORKING OUT SPACE

Answer:**Question 6** **Non-Calculator****(3 marks)**

By completing the square, find the coordinates of the maximum point of the curve $y = 13 + 6x - x^2$.

WORKING OUT SPACE

Answer:

Quadratic Simultaneous Equations

EDEXCEL GCSE EXAM PRACTICE

Total: 24 marks

Quadratic Simultaneous Equations — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator

(4 marks)

Solve algebraically the simultaneous equations:

$$x^2 + y^2 = 26$$

$$x + y = -6$$

WORKING OUT SPACE

Answer:

Question 2 ☒ Non-Calculator

(4 marks)

Solve algebraically the simultaneous equations:

$$x^2 + y^2 = 25$$

$$y = x + 1$$

WORKING OUT SPACE

Answer:

Question 3 ☒ Non-Calculator

(4 marks)

Solve algebraically the simultaneous equations:

$$x^2 + y^2 = 17$$

$$x + 4y = 0$$

WORKING OUT SPACE

Answer:

Question 4 **Non-Calculator****(4 marks)**

Solve algebraically the simultaneous equations:

$$3x^2 + 2y^2 = 35$$

$$3x + y = 7$$

WORKING OUT SPACE

Answer:

Question 5 **Calculator****(4 marks)**

Solve algebraically the simultaneous equations:

$$3x^2 - y^2 = 11$$

$$3x - 5y = -11$$

WORKING OUT SPACE

Answer:

Question 6 **Non-Calculator****(4 marks)**

Solve algebraically the simultaneous equations:

$$2x^2 - 3y^2 = 2$$

$$2x - 3y = 2$$

WORKING OUT SPACE

Answer:

Quadratic Inequalities

EDEXCEL GCSE EXAM PRACTICE

Total: 13 marks

Quadratic Inequalities — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator

(2 marks)

Solve $x^2 - 36 > 0$

WORKING OUT SPACE

Answer:

Question 2 ☒ Non-Calculator

(2 marks)

Solve $x^2 \leq 25$

WORKING OUT SPACE

Answer:

Question 3 ☒ Non-Calculator

(2 marks)

Solve $x^2 + x - 30 \geq 0$

WORKING OUT SPACE

Answer:

Question 4 **Non-Calculator****(2 marks)**Solve $x^2 - x \leq 20$

WORKING OUT SPACE

Answer:**Question 5** **Non-Calculator****(2 marks)**Solve $3x^2 - 10x - 8 < 0$

WORKING OUT SPACE

Answer:**Question 6** **Calculator****(3 marks)**

Work out the integer values that satisfy:

 $2x^2 + 7x - 13 < 0$

WORKING OUT SPACE

Answer:

Iteration

EDEXCEL GCSE EXAM PRACTICE

Total: 15 marks

Iteration — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 Calculator

(3 marks)

The volume of water, in litres, in a solar storage tank t days from now is y_t where:

$$y_0 = 4000$$

$$y_{t+1} = 0.95(y_t + 120)$$

Work out the volume of water in the tank 3 days from now. Give your answer to the nearest whole number.

WORKING OUT SPACE

Answer:

Question 2 Calculator

(3 marks)

Using $x_{n+1} = 3 + \frac{7}{x_n^2}$ with $x_0 = 4$.

Find the value of x_3 .

Give your answer to 3 decimal places.

WORKING OUT SPACE

Answer:

Question 3 Calculator

(3 marks)

Using $x_{n+1} = \sqrt{5x_n + 3}$ with $x_0 = 4$.

Find the value of x_3 .

Give your answer to 3 decimal places.

WORKING OUT SPACE

Answer:

Question 4 Non-Calculator**(2 marks)**

Show that the equation $x^3 + 7x - 5 = 0$ has a solution between $x = 0$ and $x = 1$.

WORKING & PROOF SPACE

Question 5 Non-Calculator**(2 marks)**

Show that the equation $3x^3 - x^2 - 5 = 0$ can be rearranged to give $x = \sqrt{\frac{5}{3x-1}}$.

WORKING & PROOF SPACE

Question 6 Non-Calculator**(2 marks)**

The iteration formula $x_{n+1} = \frac{2}{x_n^2} + 2$ is used to solve an equation of the form $x^3 + cx^2 + d = 0$.

Find the values of c and d .

WORKING OUT SPACE

$c = \dots\dots\dots$ $d = \dots\dots\dots$

Transforming Graphs

EDEXCEL GCSE EXAM PRACTICE

Total: 13 marks

Transforming Graphs — Practice Questions

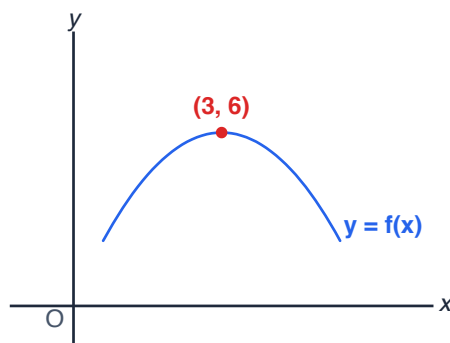
Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator

(2 marks)

Shown below is the curve with equation $y = f(x)$.

The coordinates of the maximum point of the curve are $(3, 6)$.



Write down the coordinates of the turning point of the curve with equation $y = f(x + 4)$.

WORKING OUT SPACE

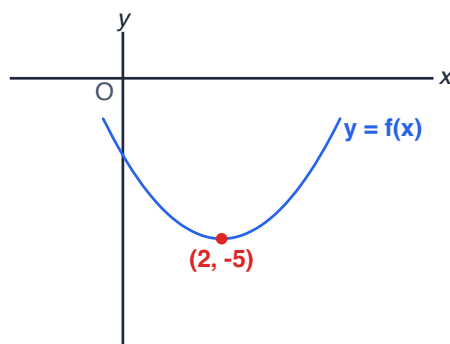
Answer:

Question 2 ☒ Non-Calculator

(2 marks)

Shown below is the curve with equation $y = f(x)$.

The coordinates of the minimum point of the curve are $(2, -5)$.



Write down the coordinates of the turning point of the curve with equation $y = f(x) + 3$.

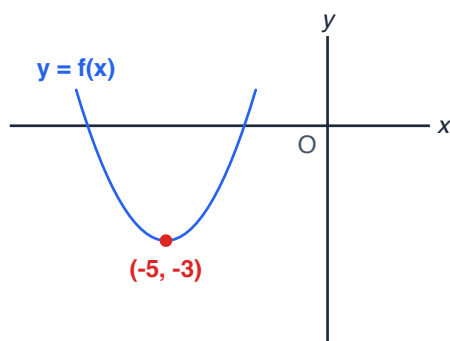
WORKING OUT SPACE

Answer:

Question 3 ✎ Non-Calculator**(2 marks)**

Shown below is the curve with equation $y = f(x)$.

The coordinates of the minimum point of the curve are $(-5, -3)$.



Write down the coordinates of the turning point of the curve with equation $y = -f(x + 2)$.

WORKING OUT SPACE

Answer:

Question 4 ✎ Non-Calculator**(2 marks)**

The curve $y = \cos x^\circ$ for $0 \leq x \leq 360$ has a minimum point at $(180, -1)$.

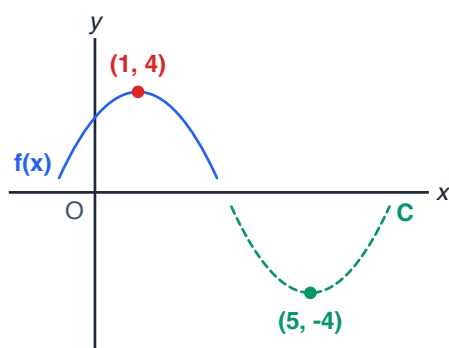
Write down the coordinates of the minimum point of the curve with equation $y = \cos(x - 45)^\circ + 2$.

WORKING OUT SPACE

Answer:

Question 5 ✎ Non-Calculator**(2 marks)**

The diagram shows the curve $y = f(x)$, which has a maximum point at $(1, 4)$, and a transformed curve C , which has a minimum point at $(5, -4)$.



Curve C has equation $y = -f(x + a)$, where a is a constant.
Find the value of a .

WORKING OUT SPACE

 $a =$ **Question 6** ✎ Non-Calculator**(3 marks)**

Curve C has equation $y = x^2 - 6x + 11$.

Curve C is translated by the vector $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ to give curve D .

Find the equation of curve D in the form $y = x^2 + bx + c$.

WORKING OUT SPACE

Answer:

Kinematics

EDEXCEL GCSE EXAM PRACTICE**Total: 18 marks**

Kinematics — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 **Non-Calculator****(2 marks)**

A particle starts from rest and moves in a straight line with a constant acceleration of 3.5 m/s^2 .

Work out the distance travelled by the particle in the first 6 seconds, in metres.

WORKING OUT SPACE

Answer:**Question 2** **Non-Calculator****(3 marks)**

A car is travelling along a straight road at 12 m/s .

It accelerates uniformly at 2 m/s^2 over a distance of 64 m .

Calculate the final speed of the car in m/s .

WORKING OUT SPACE

Answer:**Question 3** **Calculator****(3 marks)**

A high-speed train travelling at 45 m/s applies its brakes and decelerates uniformly at 1.8 m/s^2 until it comes to rest.

Calculate the distance the train travels while braking, in metres.

WORKING OUT SPACE

Answer:

Question 4 **Calculator****(3 marks)**

A motorist drives 90 km along a motorway at an average speed of 75 km/h, and then drives 42 km along country roads at an average speed of 35 km/h.

Work out the motorist's average speed for the whole 132 km journey in km/h.

WORKING OUT SPACE

Answer:**Question 5** **Non-Calculator****(3 marks)**

A particle passes a point O with velocity 4 m/s and moves in a straight line with constant acceleration 2 m/s^2 .
At time t seconds after passing O , the displacement of the particle from O is 45 m.

Form and solve a quadratic equation to find the value of t .

WORKING OUT SPACE

Answer:**Question 6** **Non-Calculator****(4 marks)**

A runner completes a 14 km training run in two stages.
She runs the first 8 km at a constant speed of x km/h, and the remaining 6 km at a constant speed of $(x - 2)$ km/h.
Her total time for the 14 km run is 2 hours.

Form and solve a quadratic equation to find her speed x , in km/h, during the first stage.

WORKING OUT SPACE

Answer:

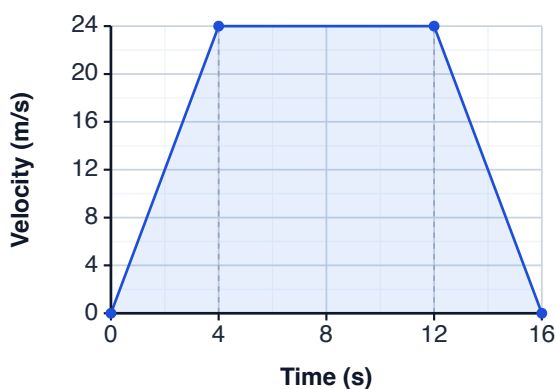
Velocity-Time Graphs

EDEXCEL GCSE EXAM PRACTICE

Total: 14 marks

Velocity-Time Graphs — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

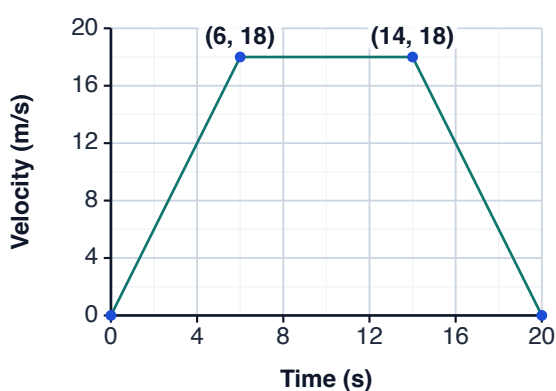
Question 1
Calculator
(2 marks)


The velocity-time graph shows the 16-second journey of a motorbike.

Calculate the **total distance** travelled by the motorbike in metres.

WORKING OUT SPACE

Answer:

Question 2
Non-Calculator
(2 marks)


The velocity-time graph shows the motion of a tram.

Work out the **acceleration** of the tram during the first **6 seconds** in m/s^2 .

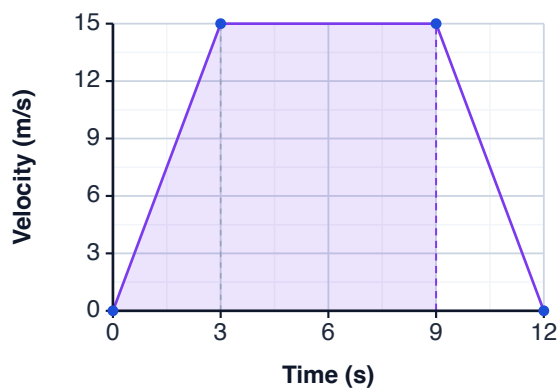
WORKING OUT SPACE

Answer:

Question 3

Calculator

(2 marks)



The velocity-time graph shows the motion of a go-kart.

Calculate the distance travelled by the go-kart in the **first 9 seconds** (the shaded region) in metres.

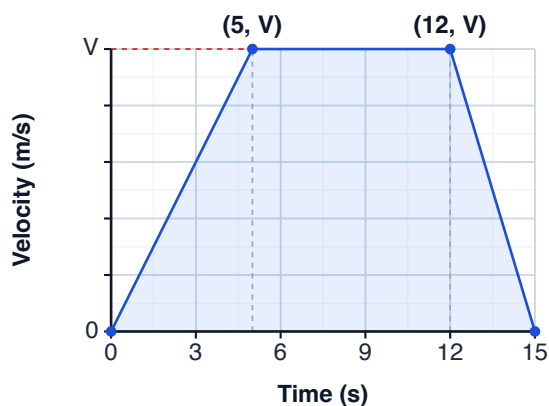
WORKING OUT SPACE

Answer:

Question 4

Non-Calculator

(2 marks)

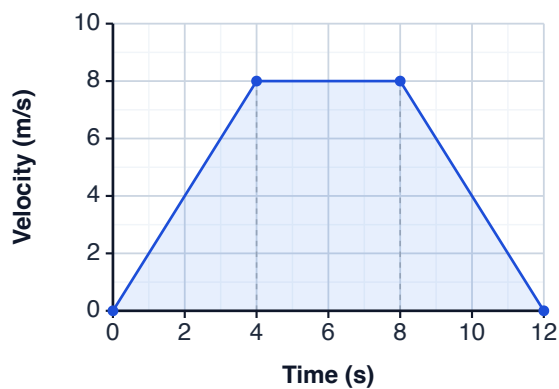


The velocity-time graph shows the journey of a sports car that reaches a maximum velocity of V m/s.

The total distance travelled during the 15 seconds is 330 m. Work out the value of V .

WORKING OUT SPACE

 $V =$

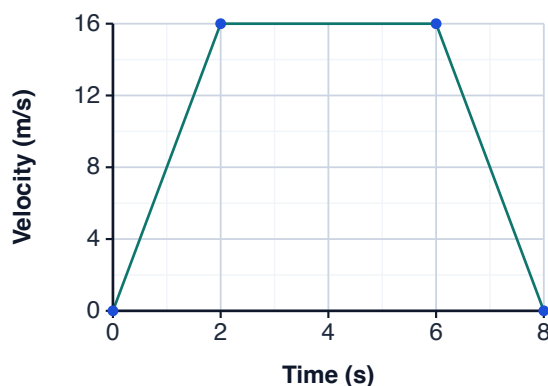
Question 5 ✎ Non-Calculator**(2 marks)**

The velocity-time graph shows the 12-second journey of a runner.

Work out the magnitude of the **deceleration** of the runner during the final **4 seconds** (between $t = 8$ s and $t = 12$ s) in m/s^2 .

WORKING OUT SPACE

Answer:

Question 6 ✎ Non-Calculator**(4 marks)**

The velocity-time graph shows the 8-second journey of a speedboat.

- (a) Work out the **average speed** of the speedboat over the whole 8-second journey in m/s .
 (b) Calculate the speed of the speedboat at $t = 7$ seconds in m/s .

WORKING OUT SPACE

(a) m/s (b) m/s

Algebraic Proof

EDEXCEL GCSE EXAM PRACTICE

Total: 19 marks

Algebraic Proof — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator

(3 marks)

Prove algebraically that the sum of the squares of any two consecutive even integers is always a multiple of 4.

WORKING & PROOF SPACE

Question 2 ☒ Non-Calculator

(3 marks)

Prove algebraically that the difference between the squares of any two consecutive odd integers is always a multiple of 8.

WORKING & PROOF SPACE

Question 3 ☒ Non-Calculator

(3 marks)

Prove algebraically that the sum of the squares of any two consecutive integers is always an odd number.

WORKING & PROOF SPACE

Question 4 ☒ Non-Calculator

(3 marks)

Prove algebraically that $(5n + 3)^2 - (5n - 3)^2$ is always a multiple of 60 for all positive integer values of n .

WORKING & PROOF SPACE

Question 5 **Non-Calculator****(3 marks)**

Prove algebraically that $(n + 5)(n - 1) + 9$ is always a square number for all integer values of n .

WORKING & PROOF SPACE

Question 6 **Non-Calculator****(4 marks)**

Prove algebraically that the square of any odd integer is always 1 more than a multiple of 8.

WORKING & PROOF SPACE

Equation of a Circle

EDEXCEL GCSE EXAM PRACTICE

Total: 17 marks

Equation of a Circle — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 Non-Calculator

(1 mark)

A circle has the equation $x^2 + y^2 = 225$.
Find the radius of the circle.

WORKING OUT SPACE

Answer:

Question 2 Calculator

(2 marks)

A circle has the equation $x^2 + y^2 = 289$.
Prove that the point $(-8, 15)$ lies on the circle.

WORKING & PROOF SPACE

Question 3 Non-Calculator

(2 marks)

A circle has the equation $x^2 + y^2 = 225$.
Calculate the exact area of the circle in terms of π .

WORKING OUT SPACE

Answer:

Question 4 **Non-Calculator****(3 marks)**

The point $P(4, k)$, where $k > 0$, lies on the circle with equation $x^2 + y^2 = 52$.

- (a) Find the value of k .
 (b) Work out the gradient of the radius OP .

WORKING OUT SPACE

(a) $k =$ (b) Gradient =

Question 5 **Calculator****(4 marks)**

A circle has the equation $x^2 + y^2 = 289$.

Find the equation of the tangent to the circle at the point $(8, 15)$.

WORKING OUT SPACE

Answer:

Question 6 **Calculator****(5 marks)**

A circle has the equation $x^2 + y^2 = 169$.

The tangent to the circle at the point $(5, 12)$ meets the y -axis at the point A and the x -axis at the point B .

- (a) Find the equation of the tangent in the form $y = mx + c$.
 (b) Work out the exact area of triangle OAB , where O is the origin.

WORKING OUT SPACE

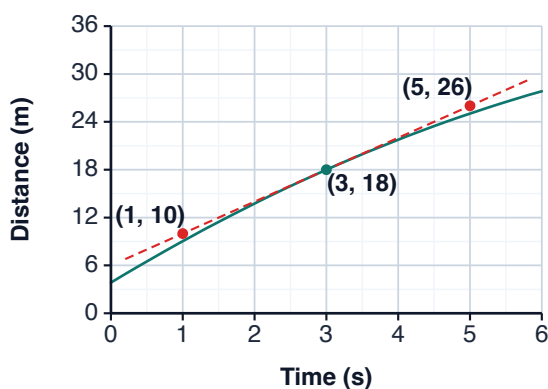
(a) (b) Area =

Gradients & Rates of Change

EDEXCEL GCSE EXAM PRACTICE**Total: 16 marks**

Gradients & Rates of Change — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator**(2 marks)**

The curved distance-time graph shows the distance travelled by a cyclist. A tangent to the curve has been drawn at $t = 3$ s, passing through $(1, 10)$ and $(5, 26)$.

Work out the **instantaneous speed** of the cyclist at $t = 3$ s in m/s.

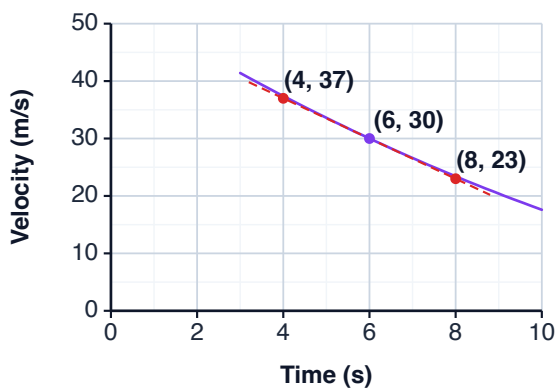
WORKING OUT SPACE

Answer:

Question 2

Calculator

(2 marks)



The velocity-time graph shows a vehicle slowing down. A tangent to the curve is drawn at $t = 6$ s, passing through (4, 37) and (8, 23).

Calculate the **rate of deceleration** (as a positive value) at $t = 6$ s in m/s^2 .

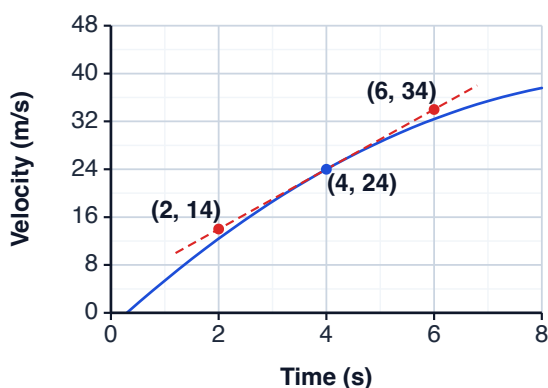
WORKING OUT SPACE

Answer:

Question 3

Non-Calculator

(2 marks)



The curved velocity-time graph shows the motion of a car. A tangent to the curve has been drawn at $t = 4$ s, passing through (2, 14) and (6, 34).

Calculate the **instantaneous acceleration** of the car at $t = 4$ s in m/s^2 .

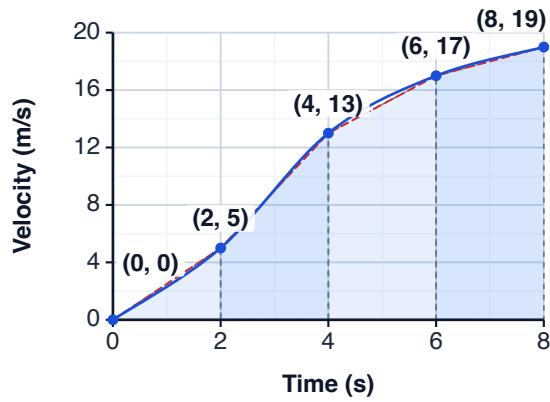
WORKING OUT SPACE

Answer:

Question 4

Calculator

(3 marks)



The velocity-time graph shows the motion of an object over 8 seconds. The area under the curve has been divided into **4 strips of equal width** ($h = 2$ s).

Use the **trapezium rule** to work out an estimate for the total distance travelled in the 8 seconds in metres.

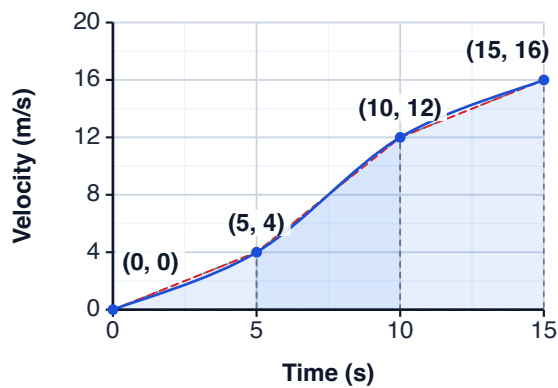
WORKING OUT SPACE

Answer:

Question 5

Calculator

(3 marks)

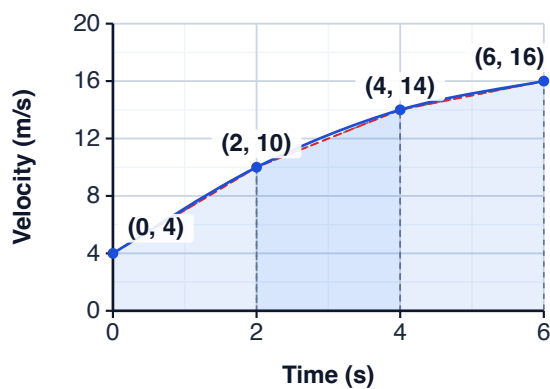


The velocity-time graph shows the motion of a train over 15 seconds. The area under the curve has been divided into **3 strips of equal width** ($h = 5$ s).

Use the **trapezium rule** to work out an estimate for the **average speed** of the train over the 15 seconds in m/s.

WORKING OUT SPACE

Answer:

Question 6 Non-Calculator**(4 marks)**

The velocity-time graph shows a speedboat accelerating from an initial velocity of 4 m/s over 6 seconds. The area under the curve has been divided into **3 trapezium strips of equal width** ($h = 2 \text{ s}$).

- (a) Work out an estimate for the distance travelled by the speedboat in the 6 seconds in metres.
- (b) State whether your answer to part (a) is an underestimate or an overestimate of the actual distance travelled. Give a reason for your answer.

WORKING OUT SPACE

(a) m

(b) Reason:

Vector Proofs

EDEXCEL GCSE EXAM PRACTICE

Total: 26 marks

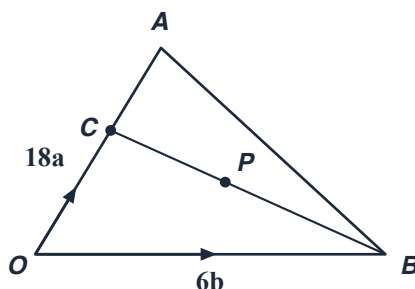
Vector Proofs — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 ☒ Non-Calculator

(4 marks)

In the diagram, OAB is a triangle with $\vec{OA} = 18\mathbf{a}$ and $\vec{OB} = 6\mathbf{b}$.
 C is the midpoint of OA , and P is the point on CB such that $CP : PB = 1 : 2$.
 Find $\vec{OP}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ in its simplest form.



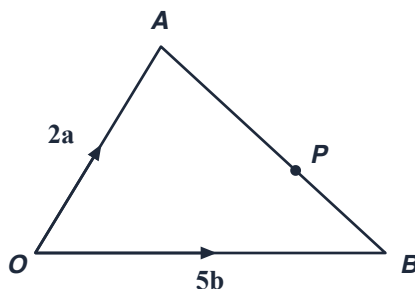
WORKING OUT SPACE

Answer:

Question 2 ☒ Non-Calculator

(4 marks)

In the diagram, OAB is a triangle with $\vec{OA} = 2\mathbf{a}$ and $\vec{OB} = 5\mathbf{b}$.
 P is the point on AB such that $AP : PB = 3 : 2$.
 Given that $\vec{OP} = k(4\mathbf{a} + 15\mathbf{b})$, find the value of k .



WORKING OUT SPACE

 $k =$

Question 3 Non-Calculator**(5 marks)**

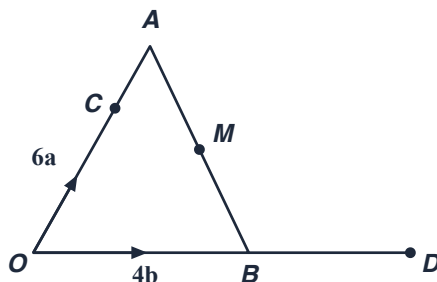
In the diagram, OAB is a triangle with $\vec{OA} = 6\mathbf{a}$ and $\vec{OB} = 4\mathbf{b}$.

C is the point on OA such that $OC : CA = 2 : 1$.

M is the midpoint of AB .

D is the point on OB extended such that $OB : BD = 1 : 1$.

Prove that C , M , and D lie on a straight line.



WORKING & PROOF SPACE

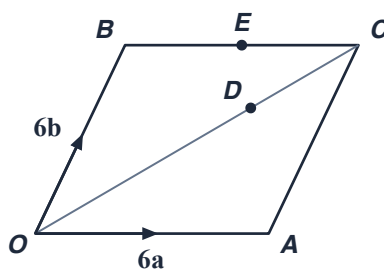
Question 4 Non-Calculator**(4 marks)**

The diagram shows a parallelogram $OACB$ with $\vec{OA} = 6\mathbf{a}$ and $\vec{OB} = 6\mathbf{b}$.

D is the point on OC such that $OD : DC = 2 : 1$.

E is the midpoint of BC .

Prove that A , D , and E lie on a straight line.



WORKING & PROOF SPACE

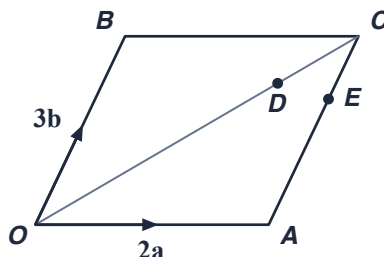
Question 5 Non-Calculator**(4 marks)**

The diagram shows a parallelogram $OACB$ with $\vec{OA} = 2\mathbf{a}$ and $\vec{OB} = 3\mathbf{b}$.

D is the point on OC such that $OD : DC = 3 : 1$.

E is a point on AC such that B, D , and E lie on a straight line.

Find the ratio $AE : EC$ in its simplest form.



WORKING OUT SPACE

Answer:

Question 6 Calculator**(5 marks)**

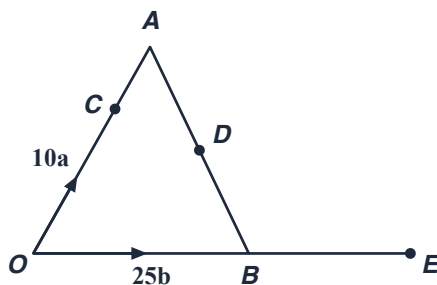
In the diagram, OAB is a triangle with $\vec{OA} = 10\mathbf{a}$ and $\vec{OB} = 25\mathbf{b}$.

C is the point on OA such that $OC : CA = 1 : 1$.

D is the point on AB such that $AD : DB = 3 : 2$.

The line OB is extended to a point E such that C, D , and E lie on a straight line.

Find the vector $\vec{BE}$ in terms of $\mathbf{b}$.



WORKING OUT SPACE

Answer:

Probability Equations

EDEXCEL GCSE EXAM PRACTICE

Total: 19 marks

Probability Equations — Practice Questions

Check the Calculator or Non-Calculator label on each question before you start. Show your working clearly in the box.

Question 1 **Non-Calculator****(3 marks)**

There are only red counters and yellow counters in a bag in the ratio 2 : 3.

Two counters are taken at random from the bag without replacement.

The probability that both counters are red is $\frac{2}{15}$.

Work out the total number of counters in the bag before any were removed.

WORKING OUT SPACE

Answer:**Question 2** **Calculator****(4 marks)**

There are only blue counters, green counters and white counters in a bag.

There are 3 times as many blue counters as green counters.

There are 4 white counters.

Two counters are taken at random from the bag without replacement.

The probability that both counters are green is $\frac{1}{40}$.

Work out the number of **blue** counters in the bag.

WORKING OUT SPACE

Answer:

Question 3 **Non-Calculator****(3 marks)**

A bag contains 6 green counters and y white counters.

A counter is taken at random from the bag, its colour is noted, and it is **replaced** in the bag.
A second counter is then taken at random.

The probability that the first counter is green and the second counter is white is $\frac{2}{9}$.

Given that $y > 6$, work out the value of y .

WORKING OUT SPACE

Answer:**Question 4** **Non-Calculator****(3 marks)**

A bag contains x green marbles and $(x + 3)$ purple marbles.

Two marbles are taken at random from the bag without replacement.

The probability that both marbles are green is $\frac{5}{39}$.

Work out the value of x .

WORKING OUT SPACE

Answer:

Question 5 **Calculator****(3 marks)**

There are n counters in a bag.

6 of the counters are red and the rest are blue.

Two counters are taken at random from the bag without replacement.

The probability that both counters are the **same colour** is $\frac{1}{2}$.

Given that more than half of the counters in the bag are blue, work out the value of n .

WORKING OUT SPACE

Answer:**Question 6** **Calculator****(3 marks)**

A box contains 4 black pens and x blue pens.

Two pens are taken at random from the box without replacement.

The probability that one pen of each colour is taken is $\frac{8}{15}$.

Given that $x > 4$, work out the value of x .

WORKING OUT SPACE

Answer:

EDEXCEL GCSE HIGHER PAPER 1 — NON-CALCULATOR (GRADE 8 & 9)

Mixed Review 1 of 2

Mixed Review 1 — Choosing the Right Method (Non-Calculator)

Total: 44 marks

These 15 unseen Grade 8 & 9 questions are mixed across topics with no topic headings — just like a real Edexcel Paper 1 exam. Identify the underlying method first, set out full algebraic or geometric working, and give exact simplified answers.

Question 1 ✎ Non-Calculator

(3 marks)

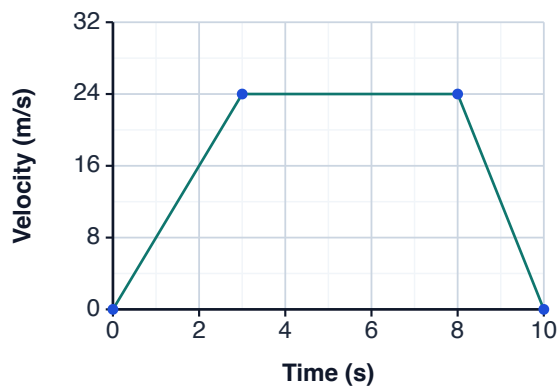
By completing the square, solve $3x^2 + 6x - 30 = 0$.
Give your answers in surd form.

WORKING OUT SPACE

Answer:

Question 2 ✎ Non-Calculator

(2 marks)



The velocity-time graph shows the motion of a sprinter.

Work out the **acceleration** of the sprinter during the first **3 seconds** in m/s^2 .

WORKING OUT SPACE

Answer:

Question 3 ✎ Non-Calculator

(2 marks)

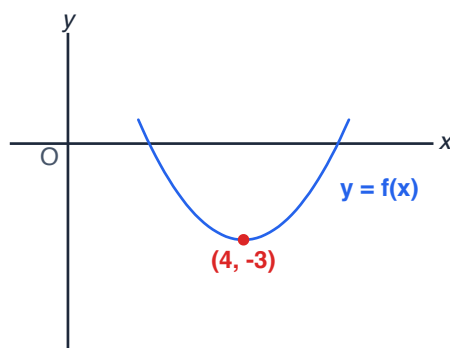
Prove algebraically that the sum of the squares of any two consecutive odd integers leaves a remainder of 2 when divided by 8.

WORKING & PROOF SPACE

Question 4 ✎ Non-Calculator**(2 marks)**

Shown below is the curve with equation $y = f(x)$.

The coordinates of the minimum point of the curve are $(4, -3)$.



Write down the coordinates of the turning point of the curve with equation $y = -f(x - 2)$.

WORKING OUT SPACE

Answer:

Question 5 ✎ Non-Calculator**(3 marks)**

A bag contains x red counters and $(x + 2)$ yellow counters.

Two counters are taken at random from the bag without replacement.

The probability that both counters are red is $\frac{2}{15}$.

Work out the value of x .

WORKING OUT SPACE

Answer:

Question 6 ✎ Non-Calculator**(3 marks)**

A hiker walks 12 km uphill at an average speed of 3 km/h and immediately walks back down the same 12 km trail at an average speed of 6 km/h.

Work out the hiker's average speed for the entire 24 km round trip in km/h.

WORKING OUT SPACE

Answer:

Question 7 ✎ Non-Calculator**(3 marks)**

A circle has the equation $x^2 + y^2 = 225$.

Calculate the exact circumference of the circle in terms of π .

WORKING OUT SPACE

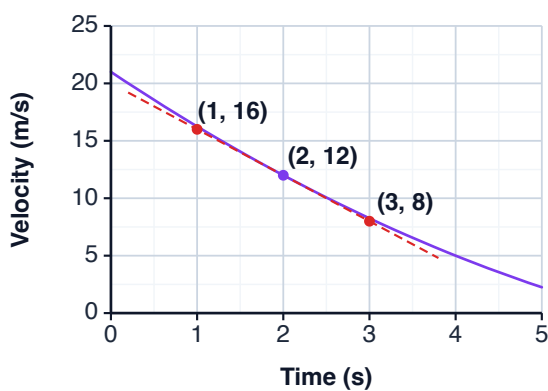
Answer:

Question 8 ✎ Non-Calculator**(2 marks)**

Solve $2x^2 - 11x + 12 \leq 0$

WORKING OUT SPACE

Answer:

Question 9 ✎ Non-Calculator**(2 marks)**

The velocity-time graph shows a vehicle slowing down. A tangent to the curve is drawn at $t = 2$ s, passing through (1, 16) and (3, 8).

Calculate the **rate of deceleration** (as a positive value) at $t = 2$ s in m/s^2 .

WORKING OUT SPACE

Answer:

Question 10 ✎ Non-Calculator**(3 marks)**

By completing the square, find the coordinates of the maximum point of the curve $y = 7 - 6x - x^2$.

WORKING OUT SPACE

Answer:

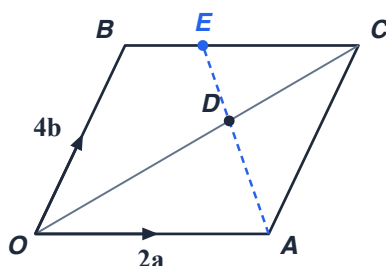
Question 11 ✎ Non-Calculator**(4 marks)**

The diagram shows a parallelogram $OACB$ with $\vec{OA} = 2\mathbf{a}$ and $\vec{OB} = 4\mathbf{b}$.

D is the point on OC such that $OD : DC = 3 : 2$.

E is a point on BC such that A , D , and E lie on a straight line.

Find the ratio $BE : EC$ in its simplest form.



WORKING OUT SPACE

Answer:

Question 12 ✎ Non-Calculator**(2 marks)**

Show that the equation $x^3 + 4x - 9 = 0$ has a solution between $x = 1$ and $x = 2$.

WORKING & PROOF SPACE

Question 13 ✎ Non-Calculator**(4 marks)**

A circle has the equation $x^2 + y^2 = 100$.

Find the equation of the tangent to the circle at the point $(-6, 8)$.

WORKING OUT SPACE

Answer:

Question 14 ✎ Non-Calculator**(4 marks)**

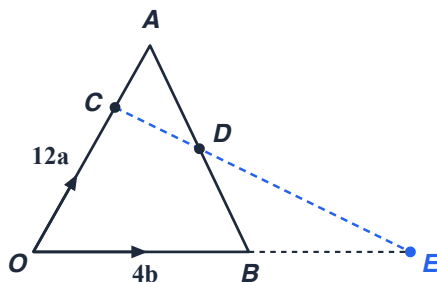
Solve algebraically the simultaneous equations:

$$x^2 + y^2 = 13$$

$$2x + 3y = 0$$

WORKING OUT SPACE

Answer:

Question 15 ✎ Non-Calculator**(5 marks)**In the diagram, OAB is a triangle with $\vec{OA} = 12\mathbf{a}$ and $\vec{OB} = 4\mathbf{b}$. C is the point on OA such that $OC : CA = 1 : 2$. D is the point on AB such that $AD : DB = 3 : 1$.The line OB is extended to a point E such that C, D , and E lie on a straight line.Find the vector $\vec{BE}$ in terms of $\mathbf{b}$.

WORKING OUT SPACE

Answer:

Mixed Review 2 — Choosing the Right Method (Calculator)**Total: 47 marks**

These 15 unseen Grade 8 & 9 questions are interleaved across topics to test method selection under Paper 2/3 conditions. Write down every equation, substitution, or area calculation clearly before rounding your final answer.

Question 1 **Calculator****(3 marks)**

The value, in pounds, of an endowment fund t years from now is y_t where:

$$y_0 = 50,000$$

$$y_{t+1} = 1.05(y_t - 500)$$

Work out the value of the fund 3 years from now. Give your answer to the nearest whole number.

WORKING OUT SPACE

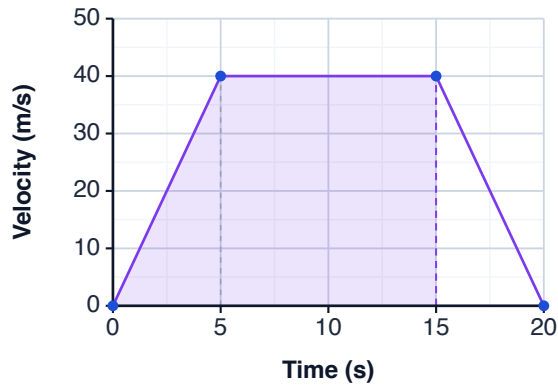
Answer:**Question 2** **Calculator****(4 marks)**

A circle has the equation $x^2 + y^2 = 289$.

Find the equation of the tangent to the circle at the point $(15, -8)$.

WORKING OUT SPACE

Answer:

Question 3 **Calculator****(2 marks)**

The velocity-time graph shows the motion of a train.

Calculate the distance travelled by the train in the **first 15 seconds** (the shaded region) in metres.

WORKING OUT SPACE

Answer:

Question 4 **Calculator****(3 marks)**

By completing the square, solve $4x^2 - 8x - 116 = 0$.

Give your answers to 2 decimal places.

WORKING OUT SPACE

Answer:

Question 5 **Calculator****(3 marks)**

There are only red counters, yellow counters and black counters in a bag.

There are **2** times as many red counters as yellow counters.

There are **3** black counters.

Two counters are taken at random from the bag without replacement.

The probability that both counters are yellow is $\frac{2}{35}$.

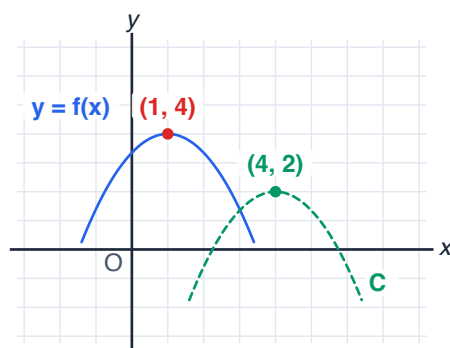
Work out the number of **red** counters in the bag.

WORKING OUT SPACE

Answer:

Question 6 **Calculator****(2 marks)**

The diagram shows the curve $y = f(x)$ with maximum point $(1, 4)$ and a translated curve C with maximum point $(4, 2)$.



The equation of curve C is $y = f(x - a) + b$.
Find the values of a and b .

WORKING OUT SPACE

 $a = \dots\dots\dots$ $b = \dots\dots\dots$
Question 7 **Calculator****(3 marks)**

A stone is dropped from rest from the top of a vertical cliff and falls freely under gravity ($a = 9.8 \text{ m/s}^2$).
The stone hits the sea 4 seconds later.

Work out the height of the cliff in metres.

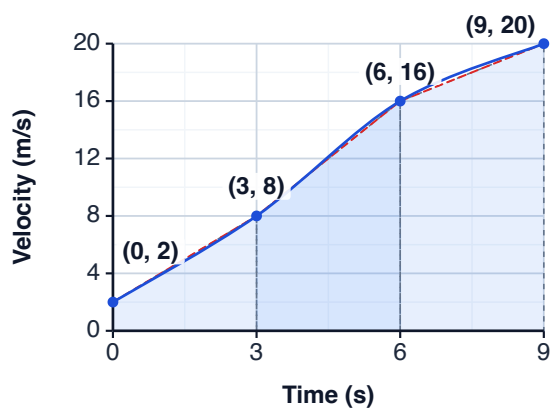
WORKING OUT SPACE

Answer: $\dots\dots\dots$

Question 8

Calculator

(3 marks)



The velocity-time graph shows the motion of an object over 9 seconds. The area under the curve has been divided into **3 strips of equal width** ($h = 3$ s).

Use the **trapezium rule** to work out an estimate for the total distance travelled in the 9 seconds in metres.

WORKING OUT SPACE

Answer:

Question 9

Calculator

(3 marks)

Using $x_{n+1} = 2 + \frac{2}{x_n^2}$ with $x_0 = 1$.

Find the value of x_3 .

Give your answer to 3 decimal places.

WORKING OUT SPACE

Answer:

Question 10

Calculator

(3 marks)

Work out the integer values that satisfy:

$$x^2 - x - 11 < 0$$

WORKING OUT SPACE

Answer:

Question 11 **Calculator****(3 marks)**

There are n counters in a bag.
6 of the counters are white and the rest are blue.

Two counters are taken at random from the bag without replacement.

The probability that both counters are white is $\frac{3}{38}$.

Work out the value of n .

WORKING OUT SPACE

Answer:**Question 12** **Calculator****(2 marks)**

Prove algebraically that $(2n + 2)^2 + (2n + 4)^2$ is always a multiple of 4 for all integer values of n .

WORKING & PROOF SPACE

Question 13 **Calculator****(4 marks)**

A cyclist rides 18 km at a constant speed of x km/h and then 15 km at a constant speed of $(x + 3)$ km/h.
The total time for the journey is 2.5 hours.

Form and solve a quadratic equation to find the value of x .

WORKING OUT SPACE

Answer:**Question 14** **Calculator****(4 marks)**

Solve algebraically the simultaneous equations:

$$x^2 + y^2 = 25$$

$$2x - y = 10$$

WORKING OUT SPACE

Answer:

Question 15



(5 marks)

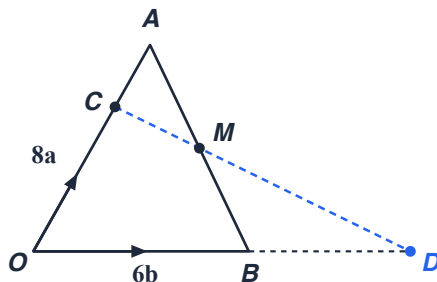
In the diagram, OAB is a triangle with $\vec{OA} = 8\mathbf{a}$ and $\vec{OB} = 6\mathbf{b}$.

C is the point on OA such that $\vec{OC} = 6\mathbf{a}$.

M is the midpoint of AB .

D is the point on OB extended such that C , M , and D lie on a straight line.

Find the vector $\vec{OD}$ in terms of $\mathbf{b}$.



WORKING OUT SPACE

Answer:

APPENDIX

Answers & Mark Schemes

Complete Edexcel Higher answers, required factorised algebraic forms, and Mixed Review topic guides.

Topic 1: Completing the Square

Q1 (Non-Calc): $(x + 4)^2 + 7$ [2m]

Q2 (Non-Calc): $3(x + 5)^2 + 4$ [3m]

Q3 (Non-Calc): $8 - \sqrt{26}, 8 + \sqrt{26}$ [3m]

Q4 (Calc): $-8.90, 0.90$ [3m]

Q5 (Non-Calc): $(3, -7)$ [3m]

Q6 (Non-Calc): $(3, 22)$ [3m]

Topic 2: Quadratic Simultaneous Equations

Q1 (Non-Calc): $(-5, -1)$ and $(-1, -5)$ [4m]

Q2 (Non-Calc): $(-4, -3)$ and $(3, 4)$ [4m]

Q3 (Non-Calc): $(-4, 1)$ and $(4, -1)$ [4m]

Q4 (Non-Calc): $(1, 4)$ and $(3, -2)$ [4m]

Q5 (Calc): $(-2, 1)$ and $(3, 4)$ [4m]

Q6 (Non-Calc): $(-5, -4)$ and $(1, 0)$ [4m]

Topic 3: Quadratic Inequalities

Q1 (Non-Calc): $x < -6$ or $x > 6$ [2m]

Q2 (Non-Calc): $-5 \leq x \leq 5$ [2m]

Q3 (Non-Calc): $x \leq -6$ or $x \geq 5$ [2m]

Q4 (Non-Calc): $-4 \leq x \leq 5$ [2m]

Q5 (Non-Calc): $-\frac{2}{3} < x < 4$ [2m]

Q6 (Calc): $-4, -3, -2, -1, 0, 1$ [3m]

Topic 4: Iteration

Q1 (Calc): 3,755 litres [3m]

Q2 (Calc): 3.542 [3m]

Q3 (Calc): 5.382 [3m]

Q4 (Non-Calc): $f(0) = -5, f(1) = 3$
(sign change) [2m]

Q5 (Non-Calc): $x^2(3x - 1) = 5$
 $\Rightarrow x = \sqrt{\frac{5}{3x - 1}}$ [2m]

Q6 (Non-Calc): $c = -2, d = -2$ [2m]

Topic 5: Transforming Graphs

Q1 (Non-Calc): $(-1, 6)$ [2m]

Q2 (Non-Calc): $(2, -2)$ [2m]

Q3 (Non-Calc): $(-7, 3)$ [2m]

Q4 (Non-Calc): $(225, 1)$ [2m]

Q5 (Non-Calc): $a = -4$ [2m]

Q6 (Non-Calc): $y = x^2 - 2x + 6$ [3m]

Topic 6: Kinematics

Q1 (Non-Calc): 63 [2m]

Q2 (Non-Calc): 20 [3m]

Q3 (Calc): 562.5 [3m]

Q4 (Calc): 55 [3m]

Q5 (Non-Calc): 5 [3m]

Q6 (Non-Calc): 8 [4m]

Topic 7: Velocity-Time Graphs

- Q1 (Calc): **288** [2m]
 Q2 (Non-Calc): **3** [2m]
 Q3 (Calc): **112.5** [2m]
 Q4 (Non-Calc): **$V = 30$** [2m]
 Q5 (Non-Calc): **2** [2m]
 Q6 (Non-Calc): **(a) 12 m/s, (b) 8 m/s** [4m]

Topic 8: Algebraic Proof

- Q1 (Non-Calc): $8n^2 + 8n + 4 = 4(2n^2 + 2n + 1)$ [3m]
 Q2 (Non-Calc): $8n + 8 = 8(n + 1)$ [3m]
 Q3 (Non-Calc): $2n^2 + 2n + 1 = 2(n^2 + n) + 1$ [3m]
 Q4 (Non-Calc): **$60n$ (multiple of 60)** [3m]
 Q5 (Non-Calc): $n^2 + 4n + 4 = (n + 2)^2$ [3m]
 Q6 (Non-Calc): $4n^2 + 4n + 1 = 4n(n + 1) + 1 = 8k + 1$ [4m]

Topic 9: Equation of a Circle

- Q1 (Non-Calc): **15** [1m]
 Q2 (Calc): $(-8)^2 + 15^2 = 64 + 225 = 289$ [2m]
 Q3 (Non-Calc): **225π** [2m]
 Q4 (Non-Calc): **(a) $k = 6$, (b) $\frac{3}{2}$** [3m]
 Q5 (Calc): $y = -\frac{8}{15}x + \frac{289}{15}$ [4m]
 Q6 (Calc): **(a) $y = -\frac{5}{12}x + \frac{169}{12}$
(b) $\frac{28561}{120}$** [5m]

Topic 10: Gradients & Rates of Change

- Q1 (Non-Calc): **4** [2m]
 Q2 (Calc): **3.5** [2m]
 Q3 (Non-Calc): **5** [2m]
 Q4 (Calc): **89** [3m]
 Q5 (Calc): **8** [3m]
 Q6 (Non-Calc): **(a) 68 m
(b) Underestimate (chords below curve)** [4m]

Topic 11: Vector Proofs

- Q1 (Non-Calc): **$6\mathbf{a} + 2\mathbf{b}$** [4m]
 Q2 (Non-Calc): **$k = \frac{1}{5}$** [4m]
 Q3 (Non-Calc): $\overrightarrow{CD} = 4\overrightarrow{CM} = -4\mathbf{a} + 8\mathbf{b}$ (common point C) [5m]
 Q4 (Non-Calc): $\overrightarrow{AE} = \frac{3}{2}\overrightarrow{AD} = -3\mathbf{a} + 6\mathbf{b}$ (common point A) [4m]
 Q5 (Non-Calc): **2:1** [4m]
 Q6 (Calc): **$50\mathbf{b}$** [5m]

Topic 12: Probability Equations

- Q1 (Non-Calc): **10** [3m]
 Q2 (Calc): **9** [4m]
 Q3 (Non-Calc): **12** [3m]
 Q4 (Non-Calc): **5** [3m]
 Q5 (Calc): **16** [3m]
 Q6 (Calc): **6** [3m]

Mixed Review 1 — Choosing the Right Method (Non-Calculator) — Answers & Topic Guide

Q1 (Completing the Square, Non-Calc):	$-1 - \sqrt{11}, -1 + \sqrt{11}$ [3m]	Q2 (Velocity-Time Graphs, Non-Calc):	8 [2m]
Q3 (Algebraic Proof, Non-Calc):	$8n^2 + 16n + 10 = 8(n^2 + 2n + 1) + 2$ [2m]	Q4 (Transforming Graphs, Non-Calc):	$(6, 3)$ [2m]
Q5 (Probability Equations, Non-Calc):	4 [3m]	Q6 (Kinematics, Non-Calc):	4 [3m]
Q7 (Equation of a Circle, Non-Calc):	30π [3m]	Q8 (Quadratic Inequalities, Non-Calc):	$\frac{3}{2} \leq x \leq 4$ [2m]
Q9 (Gradients & Rates, Non-Calc):	4 [2m]	Q10 (Completing the Square, Non-Calc):	$(-3, 16)$ [3m]
Q11 (Vector Proofs, Non-Calc):	1:2 [4m]	Q12 (Iteration, Non-Calc):	$f(1) = -4, f(2) = 7$ (sign change) [2m]
Q13 (Equation of a Circle, Non-Calc):	$y = \frac{3}{4}x + \frac{25}{2}$ [4m]	Q14 (Quad. Simultaneous, Non-Calc):	$(-3, 2)$ and $(3, -2)$ [4m]
Q15 (Vector Proofs, Non-Calc):	8b [5m]		

Mixed Review 2 — Choosing the Right Method (Calculator) — Answers & Topic Guide

Q1 (Iteration, Calc):	£56,226 [3m]	Q2 (Equation of a Circle, Calc):	$y = \frac{15}{8}x - \frac{289}{8}$ [4m]
Q3 (Velocity-Time Graphs, Calc):	500 [2m]	Q4 (Completing the Square, Calc):	$-4.48, 6.48$ [3m]
Q5 (Probability Equations, Calc):	8 [3m]	Q6 (Transforming Graphs, Calc):	$a = 3, b = -2$ [2m]
Q7 (Kinematics, Calc):	78.4 [3m]	Q8 (Gradients & Rates, Calc):	105 [3m]
Q9 (Iteration, Calc):	2.443 [3m]	Q10 (Quadratic Inequalities, Calc):	$-2, -1, 0, 1, 2, 3$ [3m]
Q11 (Probability Equations, Calc):	20 [3m]	Q12 (Algebraic Proof, Calc):	$8n^2 + 24n + 20 = 4(2n^2 + 6n + 5)$ [2m]
Q13 (Kinematics, Calc):	12 [4m]	Q14 (Quad. Simultaneous, Calc):	$(3, -4)$ and $(5, 0)$ [4m]
Q15 (Vector Proofs, Calc):	9b [5m]		