

Answer Guide

Please attempt all questions **with** a calculator.



Year 11 – Paper 2 & 3 Revision Pack (Higher)

Paper 2: Tuesday 7th June 2022

Paper 3: Monday 13th June 2022



How to use this revision pack

1. Review the list of topics that will appear on paper 2 and 3 of the summer exams. The booklet is divided into two parts; the first half is preparation for paper 2 and the second half is for paper 3.
2. Work through the revision pages for each of the topics that will appear on the summer exams.
3. Use the electronic mark scheme to check your work and identify areas of weakness. The electronic mark scheme can be found on Teams and Satchel One.
4. Follow up with either:

A. Using the Hegarty Maths Clip Numbers to watch video tutorials on areas of weakness. You should then complete the quizzes on Hegarty to test whether you have closed your gap in knowledge.

OR

B. Follow the link for Maths Genie Exam Practice and search for the pack of questions relating to each topic (Mark Schemes Provided)

Each of these options is clearly labelled at the bottom of each page of revision.

5. You can also access whole past papers at <https://corbettmaths.com/2022/02/28/edexcel-gcse-higher-summer-2022/>
You should select Advanced Information – Paper 2 and 3 (Set A and Set B)
6. Email your class teacher if you have any questions.

Number (*see Ratio – some overlap of topic areas)		Geometry and measures	
Approximation and estimation	Error interval	Shape	Transformations
Other	Use of a calculator	Angles	Circle theorems
Algebra		Length, area and volume	Area of a rectangle
Manipulation	Simplification	Pythagoras's Theorem and Trigonometry	Volume of composite solid
	Expansion of bracket		Sine and Cosine Rules
	Factorisation	Probability	
	Laws of indices	Probability	Venn diagram
Equations and inequalities	Linear equation		Probability from a Venn diagram
	Equations of parallel lines	Statistics	
	Form an equation	Diagrams	Box plot
	Quadratic inequality	Measures	Lower and upper quartiles
Graphs	Coordinates	Populations	Compare distributions
	Transformations of functions		Capture-recapture method
	Graphs of trigonometric functions		
Functions	Inverse and composite functions		
Ratio, proportion and rates of change (*see Number – some overlap of topic areas)			
Conversions	Area		
Percentages	Depreciation		
Ratio	Use of ratio		
Proportion	Direct proportion		
	Currency conversion		
	Inverse proportion		
Compound measures	Pressure		



Advanced Information – 2H
Calculator

Section A: Number

Number (*see Ratio – some overlap of topic areas)	
Approximation and estimation	Error interval
Other	Use of a calculator

Error Intervals

A number that has been rounded to the nearest hundred is 500. Write this as an error interval.

$$450 \dots \leq x < 550$$

A number that has been rounded to 2 decimal places is 1.46. Write this as an error interval.

$$1.455 \dots \leq x < 1.465$$

A number that has been rounded to 2 significant figures is 2400. Write this as an error interval.

$$2350 \dots \leq x < 2450$$

A number that has been **truncated** to 1 decimal place is 1.5. Write this as an error interval.

$$1.5 \dots \leq x < 1.6$$

FOLLOW-UP WORK

hegartymaths

Clips 774-777

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Error Intervals

Calculator Use (Inc. Square Roots and rounding)

Work out $\frac{25.4 + 1.9^3}{6.5}$

Write down all the figures on your calculator display.

$$4.962923077$$

Use your calculator to work out $\frac{\sqrt{12.36 - 5.12}}{2.97^2}$

$$0.3050397136$$

(a) Write down all the figures on your calculator display. (2)

(b) Write your answer to part (a) correct to 2 decimal places. (1)

$$0.31$$

Use your calculator to work out $\frac{12.74 + \sqrt{9.5}}{6.04 \times 4.1}$

$$0.6389196819$$

(a) Write down all the figures on your calculator display. (2)

(b) Write your answer to part (a) correct to 2 significant figures. (1)

$$0.64$$

Use your calculator to work out $\frac{\tan 80^\circ + 1}{\tan 80^\circ - 1}$

$$1.195051466$$

(a) Write down all the figures on your calculator display. (2)

(b) Write your answer to part (a) correct to 3 significant figures. (1)

$$1.20$$

FOLLOW-UP WORK

hegartymaths

Clip 129

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Using a calculator

Section B: Algebra

Simplification and Expansion of a Bracket were also in Paper 1. Please use your old booklet to revise this topic.

Algebra	
Manipulation	Simplification
	Expansion of bracket
	Factorisation
	Laws of indices
Equations and inequalities	Linear equation
	Equations of parallel lines
	Form an equation
	Quadratic inequality
Graphs	Coordinates
	Transformations of functions
	Graphs of trigonometric functions
Functions	Inverse and composite functions

Factorisation

Factorise:

$$x^2 + 25x \quad x(x + 25)$$

$$2x^2y + 10xy \quad 2xy(x + 5)$$

$$4x^3 - 10x \quad 2x(2x^2 - 5)$$

Factorise:

$$3x^2 - 7x - 20 \\ (3x + 5)(x - 4)$$

Factorise:

$$x^2 - 10x + 21 \quad (x - 7)(x - 3)$$

$$x^2 - 4x - 21 \\ (x - 7)(x + 3)$$

Factorise:

$$(x + y)^3 + 3(x + y) \\ (x + y) [(x + y)^2 + 3] \\ (x + y)(x^2 + 2xy + y^2 + 3)$$

Laws of Indices

Simplify:

$$x^5 \div x^9 = x^{-4}$$

$$x^{-3} \times x^9 = x^6$$

$$(x^4)^5 = x^{20}$$

Simplify:

$$4x^9yz^3 \div 2x^3yz = 2x^6z^2$$

$$5x^4y^3 \times x^7y^2 = 5x^{11}y^5$$

$$(3xy^5)^4 = 81x^4y^{20}$$

Evaluate:

$$5^4 = 625$$

$$5^0 = 1$$

Write $\frac{3^4 \times 3^5}{3^2}$ as a power of 3

$$3^7$$

FOLLOW-UP WORK

hegartymaths

Clips 173-175

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Indices

Linear Equations

Solve $\frac{3x}{4} + 2 = 8$

$$x = 8$$

Solve $\frac{3x+2}{4} = 3.5$

$$x = 4$$

Solve $10 - 3x = 2x - 5$

$$x = 3$$

Solve $4x - 1 = 2x + 9$

$$x = 5$$

Solve $\frac{3x-1}{2} = \frac{5x+10}{4}$

$$x = 12$$

FOLLOW-UP WORK

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Clips 177-189

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Solving Equations

Equations of Parallel Lines

What is the gradient of a line parallel to:

$$y = 3x - 7 \quad 3$$

$$2y = 7x + 1 \quad 3.5 \text{ or } 7/2$$

$$3y - 2x = 10 \quad 2/3$$

Find the equation of a line parallel to $y = 4x + 6$, that passes through $(5, -4)$

$$y = 4x - 24$$

Find the equation of a line parallel to $2y + 5x = 6$, that passes through $(-2, 3)$

$$y = -\frac{5}{2}x - 2$$

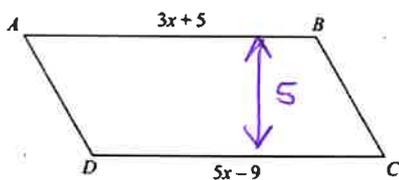
Line A passes through $(2, -1)$ and $(4, 10)$
Find the equation of the line parallel to A that passes through $(2, 7)$

$$y = \frac{11x}{2} - 4$$

FOLLOW-UP WORK **hegartymaths** Clip 214

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Parallel & Perpendicular Lines

Form an Equation



$ABCD$ is a parallelogram
All measurements are in centimetres.
The perpendicular height of the parallelogram is 5 cm.

Find the area of $ABCD$

$$130 \text{ cm}^2$$

The size of the largest angle in a triangle is three times the size of the smallest angle.

The other angle is 35° more than the smallest angle.

Work out, in degrees, the size of each angle in the triangle.
You must show your working.

$$x = 29$$

$$29^\circ, 87^\circ, 64^\circ$$

FOLLOW-UP WORK **hegartymaths** Clip 176

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Forming and Solving Equations

Quadratic Inequality

Solve $x^2 - x - 20 < 0$

$$-4 < x < 5$$

Solve $x^2 - 5x - 24 \geq 0$

$$x \leq -3 \quad x \geq 8$$

Solve $x^2 - 49 < 0$

$$-7 < x < 7$$

Solve $6x + 27 > x^2$

$$-3 < x < 9$$

FOLLOW-UP WORK

hegartymaths Clip 277

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Quadratic Inequalities

Coordinates

What is the midpoint of $(5, -2)$ and $(11, 4)$?

$$(8, 1)$$

What is the length of the line segment joined by $(5, -2)$ and $(11, 4)$?

$$6\sqrt{2} = 8.49\dots$$

The point S is on the line AB, so that the lengths AS:SB are in the ratio 2:1.

If A = $(2, 7)$ and B = $(8, 22)$ then find the coordinates of S.

$$(6, 17)$$

The point S is on the line AB, so that the lengths AS:SB are in the ratio 3:2.

If A = $(4, 26)$ and B = $(24, 11)$ then find the coordinates of S

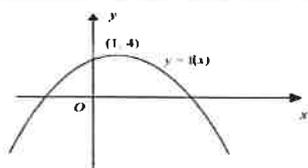
$$(16, 16)$$

FOLLOW-UP WORK

hegartymaths Clips 199-200

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Coordinates

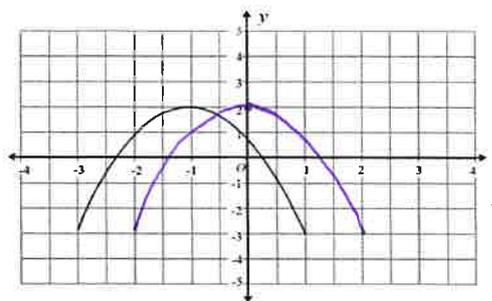
Transformation of Functions



The coordinates of the maximum point of this curve are (1, 4).
Write down the coordinates of the maximum point of the curve with the equation:

- a. $y = f(x + 3)$ (-2, 4)
- b. $y = -f(x)$ (1, -4)
- c. $y = f(x) - 3$ (1, 1)
- d. $y = f(-x)$ (-1, 4)
- e. $y = 3f(x)$ (1, 12)
- f. $y = f(2x)$ (0.5, 4)

The graph of $y = f(x)$ is shown on the grid



(a) On the grid above, sketch the graph of $y = f(x - 1)$.

The graph of $y = f(x)$ has a turning point at (-1, 2).

(b) Write down the coordinates of the turning point of $y = f(-x) + 2$

(1, 4)

FOLLOW-UP WORK

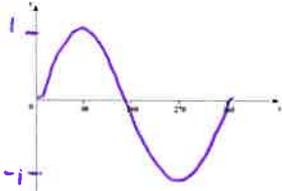
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Clips 307-313

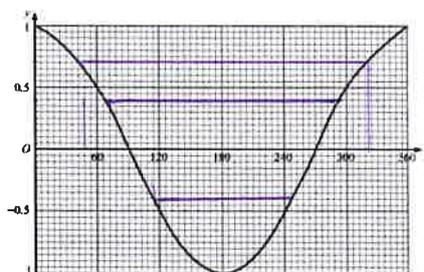
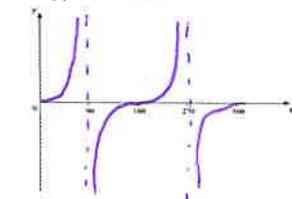
<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Transforming Graphs

Graphs of Trigonometric Functions

Match the graph of $y = \sin x$ for $0 \leq x \leq 360$



Match the graph of $y = \tan x$ for $0 \leq x < 360$



Use the graph to find estimates of the solutions, in the interval $0 \leq x \leq 360$, of the equations:

i) $\cos(x) = -0.4$

ii) $4 \cos(x) = 3$

$\cos(x) = 3/4$

- $114^\circ, 246^\circ$
 $48^\circ, 318^\circ$

FOLLOW-UP WORK

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Clips 303-306

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Trigonometric and Exponential Graphs

Inverse & Composite Functions

Given that $f(x) = x^2 - 17$ and $g(x) = x + 3$

(a) Work out an expression for $g^{-1}(x) = x - 3$

(b) Work out an expression for $f^{-1}(x) = \sqrt{x + 17}$

(c) Solve $f^{-1}(x) = g^{-1}(x)$

$$x = 8 \text{ or } x = -1$$

Given that $f(x) = 3x + 1$ and $g(x) = x^2$

(a) Find $fg(x) = 3x^2 + 1$

(b) Work out an expression for $gf(x) = (3x + 1)^2$

(c) Solve $fg(x) = gf(x)$

$$x = 0 \quad x = -1$$

FOLLOW-UP WORK

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Clips 293-297

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Inverse and Composite Functions

Section C: Ratio, Proportion & Rates of Change

Ratio, proportion and rates of change (*see Number – some overlap of topic areas)	
Conversions	Area
Percentages	Depreciation
Ratio	Use of ratio
Proportion	Direct proportion
	Currency conversion
	Inverse proportion
Compound measures	Pressure

Use of Ratio was also in Paper 1. Please use your old booklet to revise this topic.

Area Conversion

Convert the following:

2.5m^2 into cm^2 25000cm^2

27cm^2 into mm^2 2700mm^2

7m^2 into mm^2 $7,000,000\text{mm}^2$

Convert the following:

240cm^2 into m^2 0.24m^2

2700mm^2 into cm^2 27cm^2

40000mm^2 into m^2 0.04m^2

Mrs Jones is tiling her kitchen floor.
Each kitchen tile measures 20cm by 20cm.
The floor measures 3m wide and 5m long.

The tiles are sold in boxes of 10.
Each box costs £6

Work out the total cost of the tiles needed for the kitchen floor.

$£228$ (some left over)

Hint: In these questions, it is more useful to convert at the beginning of the question.

FOLLOW-UP WORK

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Clips 700-701

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Conversions and Units

Depreciation

How do you represent a decrease of 12% as a multiplier?

$\times 0.88$

How do you represent a decrease of 5% as a multiplier?

$\times 0.95$

A car costing £15,000 depreciates in value by 15% each year.

How much will it be worth after 3 years?

$£9211.88$

How many years does it take the car to half in value?

5 years

A car costing £15,000 depreciates in value by $x\%$ each year.

After 5 years it is worth £10 000?

What is the rate of depreciation? (1d.p)

7.8%

What assumption has been made?

it depreciates at the same rate each year

FOLLOW-UP WORK

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Clips 95; 808-811

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Compound Interest and Depreciation

Direct Proportion

a is directly proportional to b
 When $a = 7$, $b = 28$
 Find the value of b when $a = 5$

20

g is directly proportional to the square root of h
 When $g = 18$, $h = 16$
 Find the possible values of h when $g = 2$

16/81

x is directly proportional to the cube of y
 When $x = 32$, $y = 0.4$
 Find the value of y when $x = 256$

0.8

The table shows pairs of values for x and y

x	2	3
y	32	72

(i) Which of the following statements is correct?

$y \propto x$ $y \propto x^2$ $y \propto x^3$

(ii) Write a formula for y in terms of x .

$y = 8x^2$

FOLLOW-UP WORK

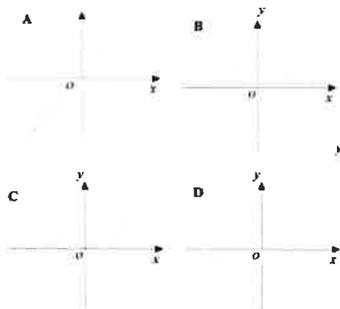
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Clips 339, 340, 341, 343, 344, 345, 348, 739

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
 Direct and Inverse Proportion

Inverse Proportion

Here are four graphs.



Match each graph with one of the four statements below.

Proportionality relationship

- y is directly proportional to x
- x is inversely proportional to y
- x is directly proportional to y^2
- y is inversely proportional to x^2

A D C B

x is inversely proportional to the square root of y

When $x = 12$, $y = 9$

Find the value of x when $y = 81$

4

a is directly proportional to \sqrt{c} .
 w is inversely proportional to a^3 .

When $c = 49$, $a = 35$
 When $a = 2$, $w = 16$.

Find the value of w when $c = 4$.

2000

FOLLOW-UP WORK

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Clips 342; 346-348

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
 Direct and Inverse Proportion

Currency Conversion

George is going on a trip to Vietnam.
He wants to change £750 into Vietnamese dong.
George wants to get as many 200 000 dong notes as possible.
The exchange rate is £1 = 29000 dong.
Work out the greatest number of 200 000 dong notes that George can get for £750

108 notes

The exchange rate in London is £1 = €1.15
The exchange rate in Berlin is £1 = €0.88
Angela wants to change some pounds into euros.
In which of these cities would Angela get the most euros?
You must show your working.

Frank is travelling from the USA to Germany.
Frank wants to book flights which cost \$710 and a hotel which costs €45 per night for 12 nights.

The exchange rates are as follows:
£1 = €1.14
\$1 = €0.85

Frank can spend no more than £1000
Work out if Frank is able to book the flights and the hotel.

\$603.50
£473.65
1077.15
No

FOLLOW-UP WORK

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Clips 707-708

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Exchange Rates

Pressure

A block exerts a force of 120 Newtons on the ground.
The block has an area of 2 m².

Work out the pressure on the ground.

60 N/m²

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

A block exerts a force of 84 Newtons on a table.
The pressure on the table is 30 N/m².

Work out the area of the box that is in contact with the table.

2.8 m²

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

A television is placed on a table.

The area of the television in contact with the table is 750 cm².
The pressure on the table is 1760 newtons/m².

Work out the force exerted by the television on the table.

132 N

Hint: The Area needs to be converted to m².

FOLLOW-UP WORK

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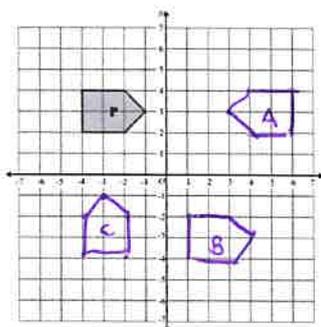
Clips 734-737

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>

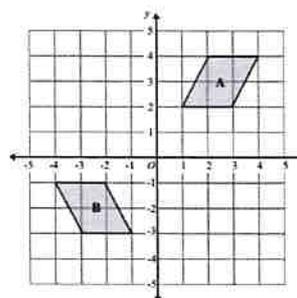
Section D: Geometry & Measures

Geometry and measures	
Shape	Transformations
Angles	Circle theorems
Length, area and volume	Area of a rectangle
	Volume of composite solid
Pythagoras's Theorem and Trigonometry	Sine and Cosine Rules

Transformations



- (a) Reflect shape P in the line $x = 1$.
Label the new shape A.
- (b) Translate shape P by the vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$.
Label the new shape B.
- (c) Rotate shape P by 90° anticlockwise, centre O.
Label the new shape C.



Shape A is transformed to shape B by a reflection in the x axis followed by a translation $\begin{pmatrix} p \\ q \end{pmatrix}$.
Find the value of p and the value of q .

$$p = -5$$

$$q = 1$$

FOLLOW-UP WORK

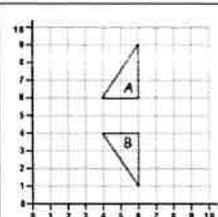
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Clips 637-
657

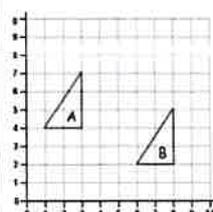
<https://www.mathsgenie.co.uk/acse-may-june-2022-higher-topics.html>
Transformations

Describing Transformations

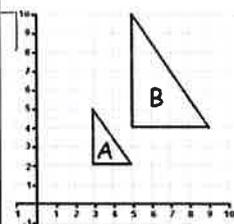
Describe what single transformation maps shape A to Shape B.



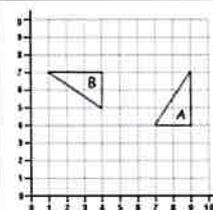
Reflection
in line $y = 5$



Translation
Vector $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$



Enlargement
s.f. 2
Centre $(1, 0)$



Rotation
 90° A-C (or 270° clockwise)
Centre $(5, 3)$

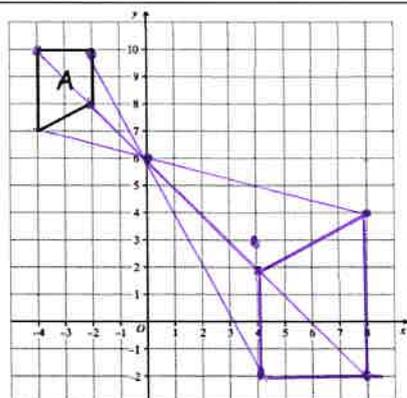
FOLLOW-UP WORK

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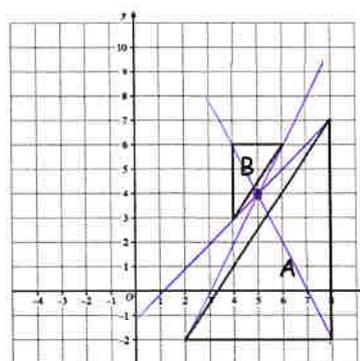
Clips 637-657

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Transformations

Transformations



Enlarge the triangle by scale factor -2 , using centre of enlargement $(0, 0)$



Describe fully the single transformation that maps shape A onto shape B.

Enlargement s.f. -3 centre $(5, 4)$

FOLLOW-UP WORK

hegartymaths

Clips 637-657

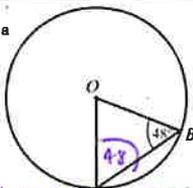
<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Transformations

Circle Theorems

A and *B* are points on the circumference of a circle, centre *O*.

Angle $\angle ABO = 48^\circ$

Find the size of angle $\angle AOB$.
Give a reason for your answer.

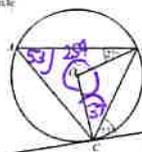


$\angle OAB = 48^\circ$
Two radii make isosceles triangle.
Angles in Δ add to 180°
 $\angle AOB = 84^\circ$

A, *B* and *C* are points on the circumference of a circle, centre *O*.
DCE is a tangent to the circle.

Angle $\angle ABO = 27^\circ$
Angle $\angle BCE = 53^\circ$

Find the size of angle $\angle CO$.
Give reasons for each stage of your working.



$\angle COB = 37^\circ$
Radius meets tangent at 90°
 $\angle BOC = 106^\circ$
 $\angle CAB = 53^\circ$ angle at circumference half angle at centre

A and *B* are points on the circumference of a circle, centre *O*.
DCE is a tangent to the circle.

Angle $\angle ACD = 76^\circ$

(a) Find the size of angle $\angle ACO$.
Give reasons for each stage of your working.

(b) Find the size of angle $\angle ABC$.
Give reasons for each stage of your working.

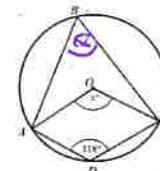


Angles in opposite segments are equal.
radius meets tangent at 90°

A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.

Angle $\angle ADC = 118^\circ$
Angle $\angle AOC = x^\circ$

Work out the value of *x*.
You must show all your working.



$\angle ABC = 62^\circ$ opposite angles in cyclic quad add to 180
 $x = 124^\circ$ angle at centre twice angle at circumference

FOLLOW-UP WORK

hegartymaths

Clips 593 – 606, 816 – 820

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Circle Theorems

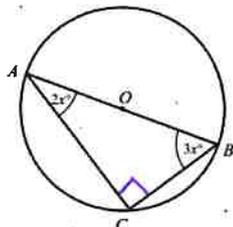
Circle Theorems (Harder)

A, *B* and *C* are points on the circumference of a circle, centre *O*.

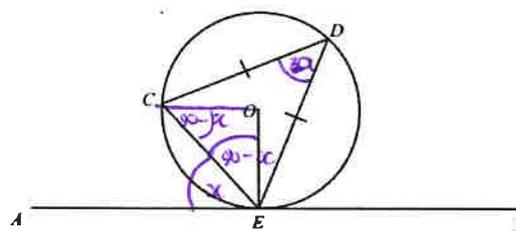
Angle $\angle CAB = 2x^\circ$
Angle $\angle ABC = 3x^\circ$

Find the value of *x*.
You must show all your working.

$5x = 90$
 $x = 18^\circ$



Angles in semi-circle is 90°



C, *D* and *E* are points on a circle, centre *O*.
AEB is a tangent to the circle at *E*.

$OC = DE$
Angle $\angle AEC = x^\circ$

Find the size of angle $\angle OED$, in terms of *x*.
Give reasons for each stage of your working.

$\angle COE = 180 - (90 - x) - (90 - x) = 2x$

FOLLOW-UP WORK

hegartymaths

Clips 593 – 606, 816 – 820

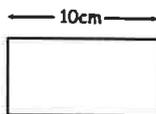
<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Circle Theorems

$$\frac{180 - 2x}{2} = 90 - \frac{x}{2}$$

$$\left(90 - \frac{x}{2}\right) - (90 - x) = \frac{x}{2}$$

Area of a rectangle

Here is a rectangle with perimeter 30cm.

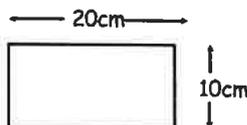


The length of the rectangle is 10cm.

Work out the area of the rectangle.

50cm^2

Shown below is a rectangle with length 20cm and width 10cm.



The length of the rectangle is increased by 20%.
The width of the rectangle is increased by 5%.

Find the percentage increase in the area of the rectangle.

26%

FOLLOW-UP WORK

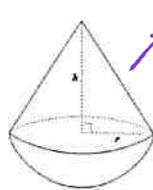
hegartymaths

Clips 544-555

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Area and Perimeter

Volume of a Composite Solid

The diagram shows a solid made up of a cone and a hemisphere.



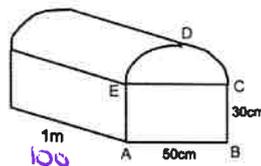
$\frac{1}{3} \times \pi \times 5^2 \times 8$
 $= \frac{200\pi}{3}$

The radius of the cone is 5cm.
The height of the cone is 8cm.
The volume of a hemisphere is $\frac{2}{3}\pi r^3$

Calculate the volume of the solid.

~~292.77cm^3~~

$\frac{2}{3} \times \pi \times 5^3$
 $= \frac{250\pi}{3}$
 471.2389cm^3



Shown above is a prism that is 1m long.

ABCDE is the cross-section of the prism.
ABCE is a rectangle and CDE is a semi-circle.

Calculate the volume of the prism.
Give your answer correct to 1 decimal place.

$150,000\text{cm}^3$
 $+ 31250\pi$

$248,174.8\text{cm}^3$

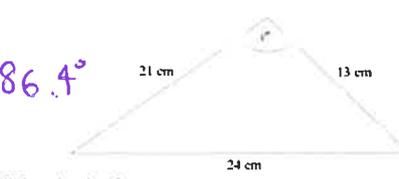
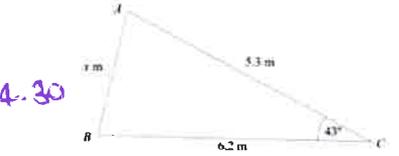
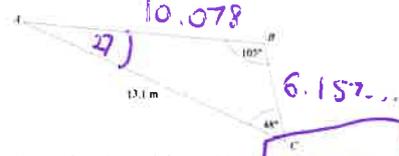
FOLLOW-UP WORK

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Clips 582

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>

Sine & Cosine Rules

 <p>Work out the value of x. Give your answer to 3 significant figures.</p>	 <p>Work out the value of x. Give your answer to 1 decimal place.</p>
 <p>Work out the value of x. Give your answer to 3 significant figures.</p>	 <p>Work out the perimeter of triangle ABC. Give your answer to 3 significant figures.</p>

FOLLOW-UP WORK

hegartymaths

Clips 521-533

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
The Sine Rule; The Cosine Rule

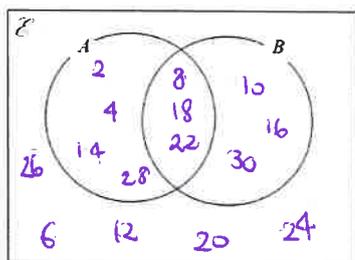
Section E: Probability

Probability	
Probability	Venn diagram
	Probability from a Venn diagram

Venn Diagrams

\mathcal{C} = {even numbers between 1 and 31}
 A = {2, 4, 8, 14, 18, 22, 28}
 B = {6, 10, 16, 20, 24, 30}

(a) Complete the Venn diagram to represent this information.



- (b) Find $P(A \cup B)$ $10/15 = 2/3$
 (c) List the elements $A \cap B$ 8, 18, 22
 (d) Find $P(A')$ $8/15$

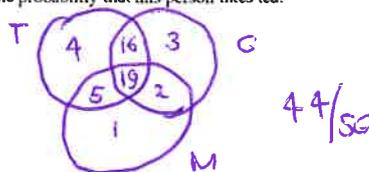
Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks

- ✓ 9 people like all three drinks.
- ✓ 16 people like tea and coffee but do not like milk.
- ✓ 21 people like coffee and milk.
- ✓ 24 people like tea and milk.
- ✓ 40 people like coffee.
- 1 person likes only milk.

Sami selects at random one of the 50 people.

Work out the probability that this person likes tea.



FOLLOW-UP WORK

hegartymaths

Clips 372-380

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
 Venn Diagrams

Section F: Statistics

Statistics	
Diagrams	Box plot
Measures	Lower and upper quartiles
Populations	Compare distributions
	Capture-recapture method

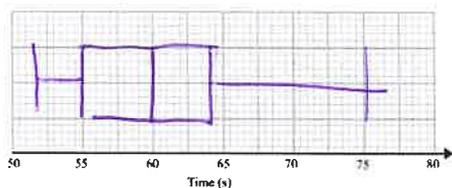
Box Plots/Quartiles/Comparing Distributions

$M=12, LQ=15, Med=18, UQ=23, Max=29$

The times, in seconds, of 15 students running a race are recorded below.

52 54 54 55 58 58 59 60 60 61 61 64 67 70 75

Draw a box plot for this information.



The table shows some information about times, in minutes, it took some boys to complete a puzzle.

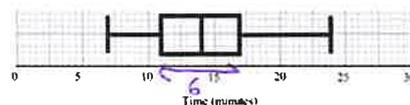
Inter Quartile Range	Minimum	Median	Upper Quartile	Maximum
8	12	18	23	29

(a) Sketch and label a box plot for this information.

$IQR = 8$

Some girls also completed the puzzle.

The box plot below shows the distribution of times the girls took to complete the puzzle.



(b) Compare the distribution of girls' times and the boys' times.

On average girls took less time.
Girls were also more consistent (lower IQR)

FOLLOW-UP WORK

hegartymaths

Clips 434-436; 440; 411; 432-433; 439

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Box Plots

Capture/Recapture

Ravina wants to find an estimate for the number of birds in a sanctuary.

She catches a sample of 70 birds in the sanctuary and tags each of these birds. These birds are then released back into the sanctuary.

The next day she catches a sample of 60 birds in the sanctuary. Ravina has tagged 12 of these birds.

Work out an estimate for the number of birds in the sanctuary.

350

Safur wants to estimate the number of deer in a forest.

He catches a sample of 40 deer, tags them and releases them back into the forest.

The following week, he takes a second sample of 40 deer. 5 of these deer have been tagged.

(a) Work out an estimate for the number of deer in the forest.

(b) Write down any assumptions you have made.

320

That none of the tags have fallen off

FOLLOW-UP WORK

hegartymaths

Clips 872-873

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Capture Recapture

Number (*see Ratio – some overlap of topic areas)		Ratio	Write as a ratio
Arithmetic	Negative number		1 : n form
Properties	Laws of indices		Share in a ratio
Approximation and estimation	Bounds	Proportion	Direct proportion
Other	Product rule for counting	Compound Measures	Average speed
		Growth and decay	General iterative processes
Algebra		Geometry and measures	
Manipulation	Simplification	Angles	Circle theorems
	Expansion of bracket	Length, area and volume	Area of a trapezium
	Substitute values		Similar triangles
	Difference of two squares	Pythagoras's Theorem and Trigonometry	Pythagoras's Theorem
	Expansion of brackets		Trigonometry
	Change subject of a formula		Trigonometry in 3-D
	Forming an expression	Vectors	Column vectors
	Algebraic fractions		
Equations and inequalities	Set up and solve equation	Probability	
	Simultaneous equations linear/quadratic	Probability	Dependent combined events
Graphs	Gradient of a straight line graph	Statistics	
Ratio, proportion and rates of change (*see Number – some overlap of topic areas)		Diagrams	Frequency polygon
Conversions	Time		Histogram
Percentages	Percentage decrease		
	Depreciation		
	Reverse percentage		



Advanced Information – 3H
Calculator

Section A: Number

Number (*see Ratio – some overlap of topic areas)	
Arithmetic	Negative number
Properties	Laws of indices
Approximation and estimation	Bounds
Other	Product rule for counting

This topic has been included in the previous revision booklet (paper 1) or in the first part of this booklet (paper 2).

Negative Number

Work out

$$5 - 14 = -9$$

$$-5 - 14 = -19$$

$$14 - (-5) = 19$$

$$-14 - (-5) = -9$$

Work out

$$\begin{aligned} -125 \div 5 \\ = -25 \end{aligned}$$

$$\begin{aligned} -96 \div -4 \\ = 24 \end{aligned}$$

Work out

$$6 \quad -2 \times -3$$

$$32 \quad -4 \times -8$$

$$625 \quad (-25)^2$$

$$-125 \quad (-5)^3$$

Work out

$$4x^2 - 2x + 7 \text{ when } x = -3$$

$$49$$

FOLLOW-UP WORK

hegartymaths

Clips 38-44

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Negative Number

Bounds

$$P = \frac{E}{T}$$

$E = 812$ correct to 3 significant figures $815 - 812.5$
 $T = 9.2$ correct to 1 decimal place $9.15 - 9.25$

By considering bounds, work out the value of P to a suitable degree of accuracy.
Give a reason for your answer.

Hint: Find the upper and lower bounds and consider to what degree of accuracy they are the same

$$UB = 88.797814207$$

$$LB = 87.72979729$$

90 the same to 1 s.f

$$v^2 = u^2 + 2as$$

$$u = \sqrt{v^2 - 2as}$$

$v = 35.2$ correct to 1 decimal place
 $a = 9.8$ correct to 1 decimal place
 $s = 60.35$ correct to 2 decimal places

Work out the upper bound for u .
Give your answer to 3 significant figures.

Hint: Rearrange formula to make u the subject

$$UB = \sqrt{v_{UB}^2 - (2 \times a_{LB} \times s_{LB})}$$

$$\begin{aligned} &= \sqrt{65.835} \\ &= 8.11 \text{ cm} \end{aligned}$$

FOLLOW-UP WORK

hegartymaths

Clips 137-139

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Bounds

Product Rule for Counting

There are 17 boys and 14 girls in a choir.
One boy and one girl will be selected to sing a duet.
Work out the total number of ways of choosing a boy and a girl.

238

There are 14 boys and x girls in a choir.
One boy and one girl will be selected to sing a duet.
Taylor says there are 152 different ways of choosing a boy and a girl.

Could Taylor be correct?
You must show your working.

$$152/14 = 10.857142857142857$$

Not whole number so no

There are 30 students in a class.
Two students are going to be selected to receive a prize.

How many different pairs of students could be selected?

435

There are 20 people in a room.
Each person shakes each other person's hand once.

Work out the number handshakes that take place.

190

FOLLOW-UP WORK

hegartymaths

Clips 671-673

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Product Rule for Counting

Section B: Algebra

Algebra	
Manipulation	Simplification
	Expansion of bracket
	Substitute values
	Difference of two squares
	Expansion of brackets
	Change subject of a formula
	Forming an expression
	Algebraic fractions
Equations and inequalities	Set up and solve equation
	Simultaneous equations linear/quadratic
Graphs	Gradient of a straight line graph

These topics have been included in the previous revision booklet (paper 1) or in the first part of this booklet (paper 2).

Substituting Values

$$w = 5x^2 + 3$$

$$x = -3$$

Work out the value of w .

$$48$$

$$s = ut + \frac{1}{2}at^2$$

$$u = -5, a = 4 \text{ and } t = 3$$

Work out the value of s .

$$3$$

Given that $f(x) = x^2 - 3$ find:

(a) $f(10)$ 97

(b) $f(-1)$ -2

(c) Solve: $f^{-1}(x) = 8$ $\sqrt{x+3}$

Solve $x^2 + 2x - 7 = 0$

Give your answers in the form $a \pm b\sqrt{c}$.

Hint: Use the Quadratic Formula

$$\frac{-2 \pm \sqrt{4 - (4 \times 1 \times -7)}}{2}$$

FOLLOW-UP WORK

hegartymaths

Clips 278-
279-780-789

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Substitution

$$\begin{aligned} \downarrow f^{-1}(x) &= \sqrt{x+3} \\ \sqrt{x+3} &= 8 \\ x &= 61 \end{aligned}$$

$$\begin{aligned} \downarrow \frac{-2 \pm \sqrt{32}}{2} &= \frac{-2 \pm 4\sqrt{2}}{2} \\ &= -1 \pm 2\sqrt{2} \end{aligned}$$

Difference of Two Squares

Factorise $x^2 - 25$
 $(x+5)(x-5)$

Factorise $16 - x^2$
 $(4+x)(4-x)$

Factorise $x^2 - y^2$

$$(x+y)(x-y)$$

Factorise $16x^2 - 25$

$$(4x+5)(4x-5)$$

Factorise $12x^2 - 27$

$$3(4x^2 - 9) = 3(2x+3)(2x-3)$$

Factorise $x^3 - 9x$

$$x(x^2 - 9) = x(x+3)(x-3)$$

FOLLOW-UP WORK

hegartymaths

Clips 165;
224-225

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Expanding and Factorising Quadratics

Changing the Subject

Make a the subject of the formula:

$$y = aw + b$$

$$a = \frac{y-b}{w}$$

$$a = y - 5$$

$$y = \frac{a+5}{c}$$

Make a the subject of the formula:

$$y = b - 2a$$

$$2a + y = b$$

$$a = \frac{b-y}{2}$$

Make a the subject of the formula:

$$y = 4a^2$$

$$\sqrt{y/4} = a$$

$$y = \sqrt{a-4}$$

$$y^2 + 4 = a$$

Make a the subject of the formula:

$$x = \frac{4+2ab}{2a-3}$$

$$a = \frac{4+3x}{2x-2b}$$

FOLLOW-UP WORK

hegartymaths

Clips 280-287

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Changing the Subject of the Formula; Rearranging Harder Formulae

Forming an Expression/Equation

Barney has the same number of sweets as Millie.
Barney gives 15 of his sweets to Millie.
Millie now has 4 times as many sweets as Barney.
Work out the total number of sweets that Barney and Millie have.

$$x - 15 = 4(x - 15)$$

$$x - 15 = 4x - 60$$

$$45 = 3x$$

$$15 = x$$



$$x - 15 + 4(x - 15) = 2x$$

$$5x - 75 = 2x$$

$$3x = 75$$

$$x = 25$$

ABCD is a trapezium.
STUV is a rectangle.

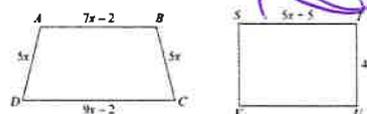


Diagram NOT
accurately drawn

All measurements are in centimetres.
The two shapes have the same perimeter.
Work out the length of ST.

$$26x - 4 = 18x + 10$$

$$8x = 14$$

$$x = 1.75$$

FOLLOW-UP WORK

hegartymaths

Clips 151-153

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Forming and Solving Equations

Simultaneous Equations

Solve the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 13 \\x &= y - 5\end{aligned}$$

$$\begin{aligned}x &= -2 & x &= -3 \\y &= 3 & y &= 2\end{aligned}$$

Solve the simultaneous equations

Give your answers to 3 significant figures

$$\begin{aligned}x^2 + y^2 &= 20 \\2x + y &= 3\end{aligned}$$

$$\begin{aligned}x &= 3.10 & x &= -0.708 \\y &= -3.22 & y &= 4.416\end{aligned}$$

FOLLOW-UP WORK

hegartymaths

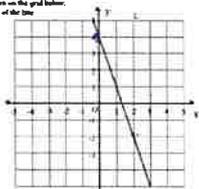
Clips 190-195; 218-219; 246; 259

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Quadratic Simultaneous Equations

Gradient

The line l is shown on the grid below.

Find the gradient of the line.



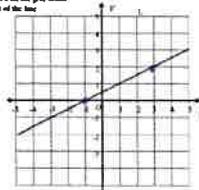
-3

Find the gradient of the line that passes through (1, -1) and (-3, -9).

2

The line l is shown on the grid below.

Find the gradient of the line.



$\frac{1}{2}$

The line AB passes through the points $A(-3, 4)$ and $(k, 12)$.
The gradient of AB is 4.
Work out the value of k .

-1

FOLLOW-UP WORK

hegartymaths

Clips 201-204; 207, 210

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Gradient of a Line

Section C: Ratio, Proportion and Rates of Change

Ratio, proportion and rates of change (*see Number – some overlap of topic areas)	
Conversions	Time
Percentages	Percentage decrease
	Depreciation
	Reverse percentage
Ratio	Write as a ratio
	1 : n form
	Share in a ratio
Proportion	Direct proportion
Compound Measures	Average speed
Growth and decay	General iterative processes

These topics have been included in the previous revision booklet (paper 1) or in the first part of this booklet (paper 2).

Time and Speed

Convert the following:

4 hours and 24 minutes into a decimal

4.4 hours

3 hours into hours and minutes

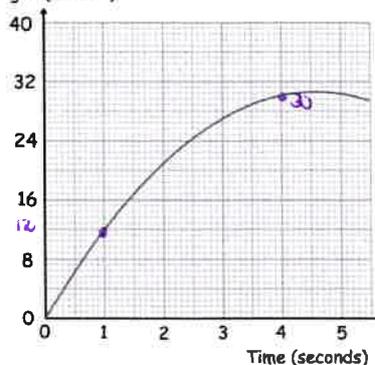
20 min 40 s

Rachel drives 300 miles from London to Newcastle. She drives the first 165 miles at an average speed of 60 mph. From this point it takes Rachel 3 hours and 15 minutes to complete her journey.

What was Rachel's average speed for the whole journey?

50 mph

Height (metres)



Work out the average speed between 1 and 4 seconds.

$$S = \frac{D}{T} = \frac{18}{3} = 6 \text{ m/s}$$

FOLLOW-UP WORK

hegartymaths

Clips 709-711: 716-724

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Speed

Reverse Percentage

The value of a house increased by 6%.
The house then had a value of £265 000
Work out the value of the house before the increase.

250,000

Mrs Reed buys a car costing £11760
This cost includes VAT at a rate of 20%.

How much is the VAT?

1960

In a sale, the normal price of a book is reduced by 20%.
The sale price of the book is £4.80
Work out the normal price of the book.

£6

There are 6000 people at an ice hockey match.
The announcer says this is exactly 40% more people than the previous match.

Explain why the announcer is incorrect.

$\frac{6000}{1.4} = 4285.7111$
Not a whole number so no

FOLLOW-UP WORK

hegartymaths

Clip 96

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Reverse Percentages

General Iterative Processes

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

With $x_0 = 2.5$

(a) Find the values of x_1 , x_2 and x_3

(3)

(b) Explain the relationship between the values of x_1 , x_2 and x_3 and the equation

$$x^2 - 2x^2 - 5 = 0$$

(2)

$$x_1 = 14/5$$

$$x_2 = 517/196$$

$$x_3 = 2.718622914$$

The number of people living in a town t years from now is P_t where

$$P_0 = 55000$$

$$P_{t+1} = 1.03(P_t - 800)$$

Work out the number of people in the town 3 years from now.

57,553

FOLLOW-UP WORK

hegartymaths

Clips 322

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
Iteration

Convergence towards solution

Section D: Geometry & Measure

Geometry and measures	
Angles	Circle theorems
Length, area and volume	Area of a trapezium
	Similar triangles
Pythagoras's Theorem and Trigonometry	Pythagoras's Theorem
	Trigonometry
	Trigonometry in 3-D
Vectors	Column vectors

These topics have been included in the previous revision booklet (paper 1) or in the first part of this booklet (paper 2).

Area of a Trapezium

Find the area of the trapezium

5.2cm Not drawn

4.5cm 6cm

10.8cm

36cm^2

6cm

x cm 7cm

12cm

The area of the trapezium is 63cm^2 .

Work out the value of x.

6cm

x cm 4cm

The area of the trapezium is 34cm^2 .

Work out the value of x.

11cm

Find the area of the trapezium

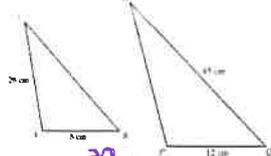
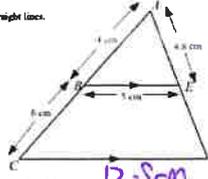
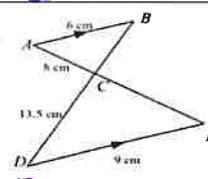
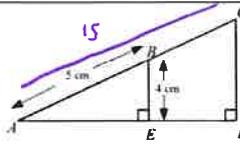
Not drawn

9cm 10cm

8cm 3cm

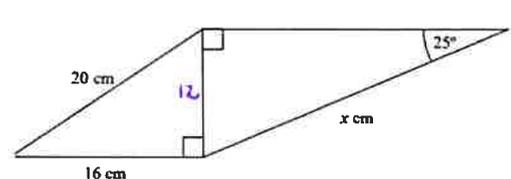
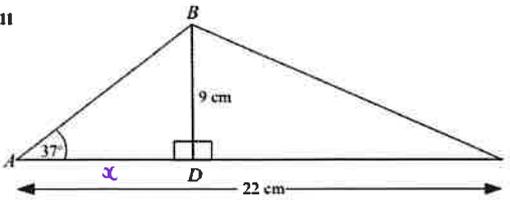
48cm^2

Similar Triangles

<p>The two triangles ABC and PQR are mathematically similar.</p> <p>Angle A = angle P. Angle B = angle Q.</p> <p>AB = 8 cm. AC = 26 cm. PQ = 12 cm. QR = 45 cm.</p>  <p>(a) Calculate the length of PR. 39 cm</p> <p>(b) Calculate the length of BC. 30 cm</p>	<p>BC is parallel to CD. ABC and AED are straight lines.</p> <p>AB = 4 cm BE = 6 cm DE = 5 cm AE = 4.8 cm.</p>  <p>(a) Calculate the length of CD. (2) 12.5 cm</p> <p>(b) Calculate the length of ED. (2) 7.2 cm</p>
<p>AB is parallel to DE. ACE and BCD are straight lines.</p> <p>AB = 6 cm. AC = 8 cm. CD = 13.5 cm. DE = 9 cm.</p>  <p>(a) Calculate the length of CE. 12 cm</p> <p>(b) Calculate the length of BC. 9 cm</p>	 <p>AB:AC = 1:3</p> <p>(a) Calculate the length of CD. (2) 12 cm</p> <p>(b) Calculate the length of BC. (2) 10 cm</p>

FOLLOW-UP WORK **hegartymaths** Clips 611-613 <https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html> Similar Shapes (Lengths)

Trigonometry

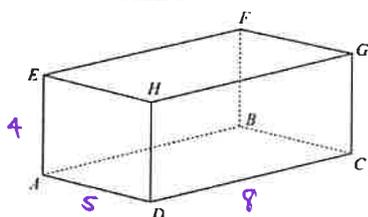
 <p>Work out the value of x. Give your answer to 1 decimal place.</p> <p>28.4 cm</p>	<p>11</p>  <p>Work out the size of angle BCD. Give your answer to 1 decimal place.</p> <p>41.8°</p>
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FOLLOW-UP WORK **hegartymaths** Clips 508-515 <https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html> SOHCAHTOA (Trigonometry)

Trigonometry in 3D

The diagram shows a cuboid $ABCDEFGH$.

$AE = 4$ cm
 $AD = 5$ cm
 $DC = 8$ cm

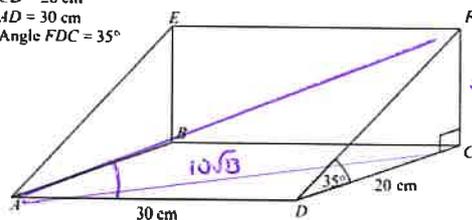


Calculate the length of AG .
 Give your answer correct to 3 significant figures.

10.2 cm

The diagram shows a triangular prism.

$CD = 20$ cm
 $AD = 30$ cm
 Angle $FDC = 35^\circ$



Calculate the size of angle the line AF makes with the plane $ABCD$.
 Give your answer correct to 3 significant figures.

21.2°

FOLLOW-UP WORK

hegartymaths

Clips 854-863

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
 3D Pythagoras and Trigonometry

Column Vectors

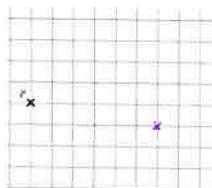
$a = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $b = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

(a) Write down as a column vector

(i) $a + b$
 $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$

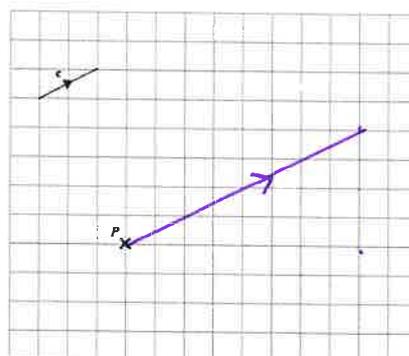
(ii) $2a - b$
 $\begin{pmatrix} 1 \\ 7 \end{pmatrix}$

Starting from P ,
 draw the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$



The vector e is drawn on the grid.

(b) From the point P , draw the vector $4e$



FOLLOW-UP WORK

hegartymaths

Clips 623-657

<https://www.mathsgenie.co.uk/gcse-may-june-2022-higher-topics.html>
 Vectors

Section E: Probability

Probability	
Probability	Dependent combined events

$$\frac{n-4}{n} \times \frac{n-5}{n-1} = \frac{1}{3}$$

$$3(n-4)(n-5) = n(n-1)$$

$$3n^2 - 27n + 60 = n^2 - n$$

$$2n^2 - 26n + 60 = 0$$

$$n^2 - 13n + 30 = 0$$

$$b. (n-10)(n-3) = 0$$

$$n=10 \text{ or } n=3$$

Dependent Combined Events

There are 10 counters in a bag.

5 of the counters are red.
3 of the counters are blue.
2 of the counters are green.

Billie takes two counters at random from the bag.

Work out the probability that both of the counters Billie takes are the same colour.
You must show your working.

$$P(R,R) = \frac{5}{10} \times \frac{4}{9}$$

$$P(B,B) = \frac{3}{10} \times \frac{2}{9}$$

$$P(G,G) = \frac{2}{10} \times \frac{1}{9}$$

$$\frac{28}{90}$$

There are n counters in a bag.

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

Ross takes a counter from the bag at random and does not replace it. He then takes another counter at random from the bag.

The probability that Ross takes two blue counters is $\frac{1}{3}$

- (a) Show that $n^2 - 13n + 30 = 0$ (5)
(b) Find the value of n . (2)

$$P(B,B) = \frac{n-4}{n} \times \frac{n-3}{n-1} = \frac{1}{3}$$

$$3(n-4)(n-3) = n(n-1)$$

$$3n^2 - 21n + 36 = n^2 - n$$

$$2n^2 - 20n + 36 = 0$$

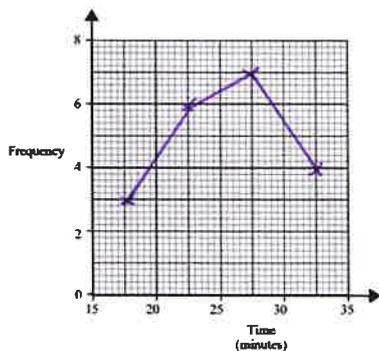
Section F: Statistics

Statistics	
Diagrams	Frequency polygon
	Histogram

The table below gives information about the time taken for 20 people to run 5 km.

Time (minutes)	Frequency
$15 < t \leq 20$	3
$20 < t \leq 25$	6
$25 < t \leq 30$	7
$30 < t \leq 35$	4

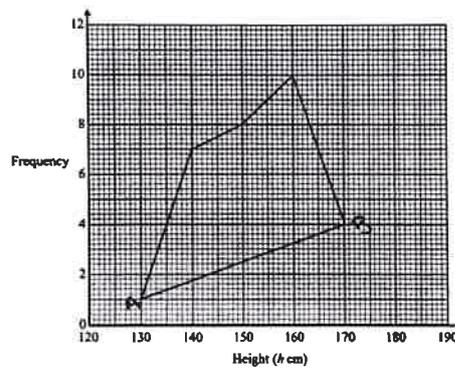
Draw a frequency polygon to show this information.



Frequency Polygons The grouped frequency table gives information about the heights of 30 students.

Height (h cm)	Frequency
$130 < h \leq 140$	1
$140 < h \leq 150$	7
$150 < h \leq 160$	8
$160 < h \leq 170$	10
$170 < h \leq 180$	4

This incorrect frequency polygon has been drawn



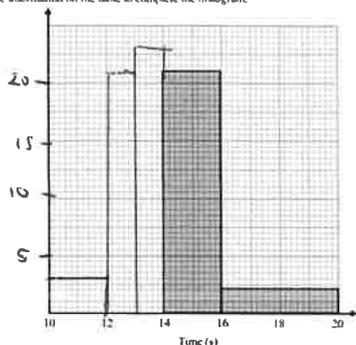
(b) Write down two things wrong with this incorrect frequency polygon.

↘ Not at midpoints
↘ connected first and last point

Histograms

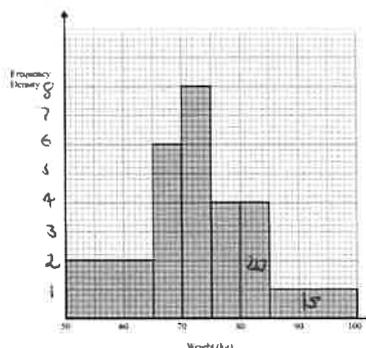
Time (s)	Frequency	FD
$10 < t \leq 12$	6	3
$12 < t \leq 13$	21	21
$13 < t \leq 14$	23	23
$14 < t \leq 16$	42	21
$16 < t \leq 20$	8	2

a) Use the information on the table to complete the histogram.



b) Use the histogram to complete the table.

The histogram shows information about the weight of pigs.



30 pigs weigh between 50 and 65 kg.

(a) Work out an estimate for the number of pigs which weigh more than 85kg.

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