

## A Level Maths/ Further Maths

As you are reading this booklet you must have expressed an interest in studying A Level Mathematics at the academy.

The course you have chosen is, like all A Levels, a challenging one and it is important that we make sure before you start the course that it is the right one for you to take.

You need to achieve at least a 7 Grade at GCSE (preferably a grade 8 or 9) to even be considered as a candidate to start the course (grade 8 for Further Maths).

We also ask you to complete all the work in this booklet and bring it with you when you are finalising your A Level choices. The work will be marked and assessed at that stage to give us additional information about your suitability to do the course. One important aspect of any A Level course is the ability to study independently and this is what we are asking you to do here.

The work is divided into 10 sections and there are 10 questions in each section. You should attempt them all. Each skill is needed at A Level and it is vital that you are confident with all of them.

You should use Hegarty Maths and any other internet resources such as You Tube to help you if you need them. GCSE revision guides will also be helpful.

Your final answers should be filled in on the answer sheet at the back of the booklet but you must bring all your working out with you as well.

## Reading List

As a student who is choosing to study Mathematics at A Level, it is logical to assume that you have an interest in the subject.

With that said, the following books may be of interest to you:

***50 Mathematical Ideas You Really Need to Know*** (Tony Crilly)

***Alex's Adventures in Numberland*** (Alex Bellos)

***Cabinet of Mathematical Curiosities*** (Ian Stewart)

***The Calculus Wars*** (Jason Socrates Bardi)

***The Code Book*** (Simon Singh)

***The Curious Incident of the Dog in the Night-time*** by Mark Haddon

***How Many Socks Make a Pair?: Surprisingly Interesting Maths*** (Rob Eastway)

***Hello World: How to be Human in the Age of the Machine*** (Hannah Fry)

***Humble Pi: A Comedy of Maths Errors*** (Matt Parker)

***The Life-Changing Magic of Numbers*** (Bobby Seagull)

***The Number My5teries*** (Marcus du Sautoy)

Thank you for expressing an interest in doing Mathematics A Level and good luck!!

## Solving Linear Equations

1.  $5(c + 3) = 3c + 1$
2.  $4(3y + 2) = 16 + 10y$
3.  $9y + 7 = 2(1 + 6y)$
4.  $4(x - 1) = 3(x + 1)$
5.  $2(2g - 5) = 4(1 - g)$
6.  $6(x - 1) = 2x + 8$
7.  $6(x + 5) = 23 - x$
8.  $3(2d - 1) = 4d - 7$
9.  $5(3x - 1) = 7(x + 1)$
10.  $5(2x + 3) = 2(3 - x) + 3$

## **Formulae**

1. State the formula for surface area of a cube
2. State the formula for volume of a cylinder
3. State the formula for total surface area of a cylinder
4. State the formula for surface area of a cylinder
5. State the formula for volume of a sphere
6. State the formula for volume of a hemisphere
7. State the formula for total surface area of a hemisphere
8. State the cosine rule, but with  $\cos A$  as the subject
9. State the formula for volume of a cone
10. State the formula for total surface area of a cone

## Crossing axes

1. Find the coordinates of the points where  $y = 2x - 1$  crosses
  - (a) The x-axis
  - (b) The y-axis
2. Find the coordinates of the points where  $2x - 3y = 12$  crosses
  - (a) The x-axis
  - (b) The y-axis
3. Find the coordinates of the points where  $y = x^2 - 4$  crosses
  - (a) The x-axis
  - (b) The y-axis
4. Find the coordinates of the points where  $y = (x - 2)(x + 3)$  crosses
  - (a) The x-axis
  - (b) The y-axis
5. Find the coordinates of the points where  $y = (2x - 3)(x + 5)$  crosses
  - (a) The x-axis
  - (b) The y-axis
6. Find the coordinates of the points where  $y = x^2 - 4x + 5$  crosses
  - (a) The x-axis
  - (b) The y-axis
7. Find the coordinates of the points where  $y = 4x^2 - 9$  crosses
  - (a) The x-axis
  - (b) The y-axis
8. Find the coordinates of the points where  $y = x^3 - 8$  crosses
  - (a) The x-axis
  - (b) The y-axis
9. Find the coordinates of the points where  $y = 2x^2 + 3x - 5$  crosses
  - (a) The x-axis
  - (b) The y-axis
10. Find the coordinates of the points where  $y = 5x^2 + 36x + 7$  crosses
  - (a) The x-axis
  - (b) The y-axis

## Simultaneous Equations

1. Solve  $x^2 + 2x + y = 0$   
 $y - 2x = 0$

2. Solve  $x^2 + 5x + 2y = 0$   
 $y - x = 6$

3. Solve  $x^2 + 3x + y = 6$   
 $x + y = 4$

4. Solve  $x^2 + y^2 = 10$   
 $x + y = 4$

5. Solve  $x^2 + y^2 = 10$   
 $x + y = 5$

6. Solve  $y = x^2 + 4$   
 $y = 2x^2 + 3x$

7. Solve  $x^2 + y = 0$   
 $y + 4x = 0$

8. Solve  $x^2 + y^2 = 10$   
 $y = x + 3$

9. Solve  $y = 3x - 2$   
 $2x + 3y = 38$

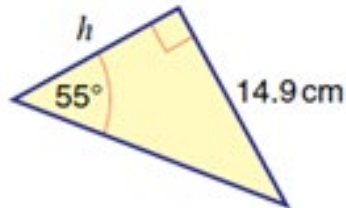
10. Solve  $3y = 4x - 1$   
 $2x - y = 2$

## Trigonometry

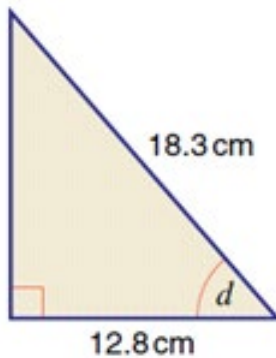
1. Calculate the length of  $a$



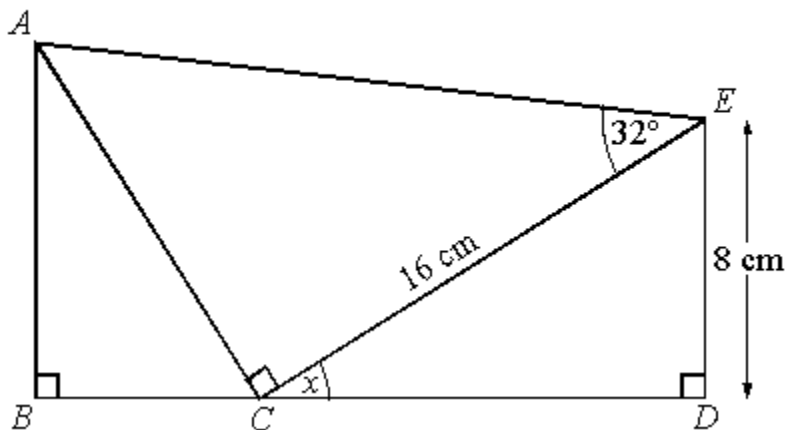
2. Calculate the length of  $h$



3. Calculate the value of angle  $d$



$BCD$  is a straight line.  $CE = 16$  cm.

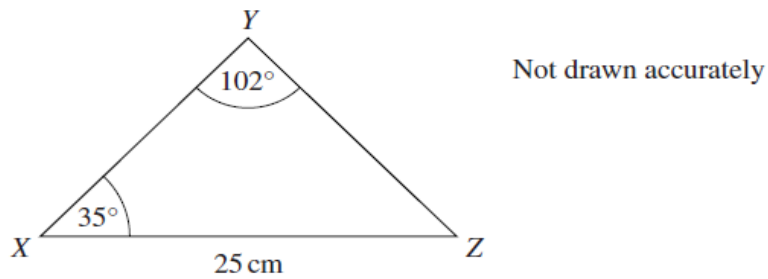


The diagram is not drawn to scale.

4. Calculate the size of the angle marked  $x$ .  
5. Calculate the length of  $AC$ .  
6. Use your answers to questions 4 & 5 to calculate the length of  $BC$ .

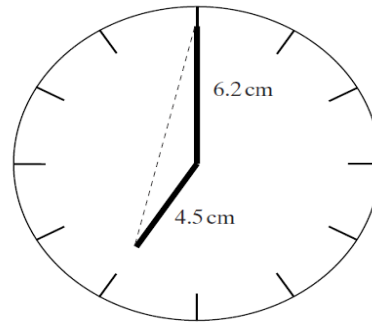
7.

In triangle  $XYZ$ , angle  $X = 35^\circ$ , angle  $Y = 102^\circ$  and  $XZ = 25$  cm



Calculate  $YZ$ .

8.

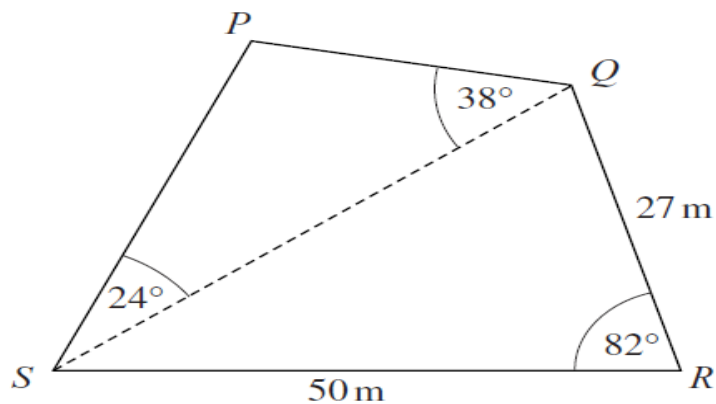


The hour hand of a clock is  $4.5$  cm long.  
The minute hand is  $6.2$  cm long.

Calculate the distance between the tips of the hands at 7 o'clock.

9.

The diagram shows the plan of a field  $PQRS$ .



Calculate the length of  $PS$ .

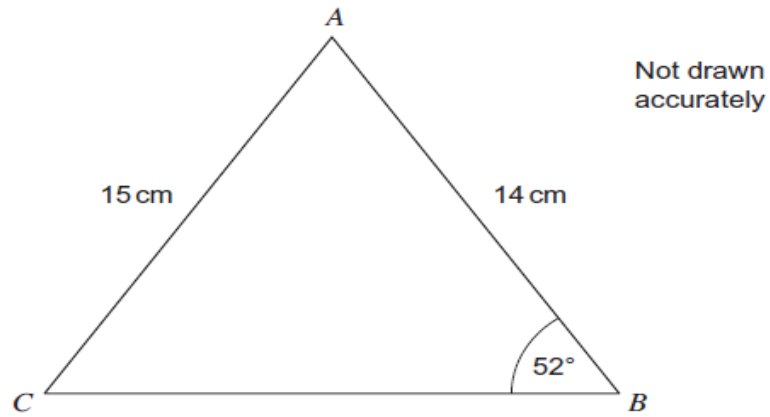


10.

$ABC$  is a triangle.

$AB = 14$  cm and  $AC = 15$  cm

$\angle ABC = 52^\circ$



Work out the largest angle in the triangle.

## Change the subject of a formula

### Question 1

Rearrange the formula to make  $v$  the subject  $T = 7(V - 8)$

### Question 2

Rearrange the formula to make  $s$  the subject  $W = s^2 + 5$

### Question 3

Rearrange the formula  $r = \frac{C}{2\pi}$  to make  $C$  the subject.

### Question 4

Make  $x$  the subject of  $y = \frac{x}{w} - t$

### Question 5

Make  $w$  the subject of  $6x = \sqrt{2w + y}$

### Question 6

You are given the formula  $y = \frac{x^2 - 49}{5}$  Make  $x$  the subject of the formula.

### Question 7

Make  $x$  the subject of the formula

$$y = \frac{m + x}{x - 2}$$

### Question 8

Make  $s$  the subject of the formula  $t = \frac{3(10 - s)}{s}$

### Question 9

Make  $v$  the subject of the formula  $f = \frac{uv}{u + v}$

### Question 10

Make  $t$  the subject of the formula  $x = \frac{3t - 5}{t - 2}$

## **Factorising**

- (1) Factorise  $10p - 4$
- (2) Factorise  $r^6 - 3r^4$
- (3) Factorise  $x^2 + 5x - 14$
- (4) Factorise completely  $3x^2 - 6xy$
- (5) Factorise  $y^2 - 9y + 14$
- (6) Factorise  $2x^2 + 3x - 5$
- (7) Factorise  $x^2 - 49$
- (8) Factorise completely  $2x^2 - 50y^2$
- (9) Factorise  $3x^2 + 5x - 12$
- (10) Factorise  $5x^2 + 36x + 7$

## Indices

### Question 1

Simplify  $8^4 \times 8^5$

Leave your answer as a power of 8.

### Question 2

Simplify  $w^6 \div w^2$

### Question 3

Chris simplifies  $3x \times 4x^5$

His answer is  $7x^5$

Explain the mistakes he has made.

### Question 4

Simplify fully  $15y^6 z^3 \div 5y^2 z$

### Question 5

Work out  $56^1 - 56^0$

### Question 6

Write  $27^{-\frac{1}{3}}$  as a fraction.

### Question 7

Work out  $10^{-2} \times 64^{\frac{1}{2}}$

### Question 8

Write down the square of the cube root of  $x$  using index notation.

### Question 9

Simplify  $\frac{(5^8)^3}{25 \times 5^4}$

Give your answer as a power of 5.

### Question 10

Express  $\frac{1}{\sqrt{16^3}}$  in the form  $2^n$ , where  $n$  is an integer.

## Non-Calculator Fraction Work

### Question 1

Calculate, in fractional form, the value of  $y = \frac{a-b}{c+d}$

When  $a = \frac{5}{6}$ ,  $b = \frac{1}{3}$ ,  $c = \frac{2}{3}$  and  $d = \frac{1}{2}$ .

### Question 2

A family has some chocolate eggs.

$\frac{1}{8}$  of the eggs are eaten on Saturday.

On Sunday, the remaining eggs are shared equally between three children.

What fraction of the eggs does each child receive on Sunday?

### Question 3

Find the value of  $\frac{\frac{1}{4} \times 16}{\frac{1}{27} \times (3)^2}$

### Question 4

Work out  $1\frac{3}{4} \div \frac{5}{7}$

### Question 5

Work out the reciprocal of 40.

Give your answer as a decimal.

### Question 6

Write  $\frac{1}{4x} + \frac{2}{3x}$  as a single fraction.

### Question 7

a Factorise  $x^2 - 3x$

b Simplify  $\frac{2}{x^2 - 3x} + \frac{3}{x}$

### Question 8

Simplify  $\frac{4}{x+3} + \frac{2}{x-2}$

### Question 9

$\frac{5x^2 + 14x - 3}{x^2 - 9}$

### Question 10

$\frac{6x^2 - x - 1}{4x^2 - 1}$

## Surds

Simplify each of the following:

1.  $\sqrt{72}$

2.  $\sqrt{4/9}$

3.  $\sqrt{3} \times \sqrt{27}$

4.  $\sqrt{200} \div \sqrt{1/4}$

5.  $\sqrt{8} + \sqrt{128} - 2\sqrt{32}$

6.  $\sqrt{12} - 5\sqrt{48} + 10\sqrt{9}$

7.  $(\sqrt{11} + \sqrt{8})(\sqrt{11} - \sqrt{8})$

8.  $(2\sqrt{3} + 4)^2$

9.  $(3\sqrt{2} + 5\sqrt{3})(5\sqrt{2} - 2\sqrt{3})$

Rationalise

10.  $\frac{1}{\sqrt{3}}$

**Answers**

**Name:** \_\_\_\_\_

**Solving Linear Equations**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
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7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_

**Formulae**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
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**Crossing Axes**

1. \_\_\_\_\_
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**Simultaneous Equations**

1. \_\_\_\_\_
2. \_\_\_\_\_
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4. \_\_\_\_\_
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10. \_\_\_\_\_

**Trigonometry**

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2. \_\_\_\_\_
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**Changing the Subject**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
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9. \_\_\_\_\_
10. \_\_\_\_\_

**Factorise**

1. \_\_\_\_\_

2. \_\_\_\_\_

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4. \_\_\_\_\_

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10. \_\_\_\_\_

**Indices**

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9. \_\_\_\_\_

10. \_\_\_\_\_

**Fractions**

1. \_\_\_\_\_

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9. \_\_\_\_\_

10. \_\_\_\_\_

**Surds**

1. \_\_\_\_\_

2. \_\_\_\_\_

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10. \_\_\_\_\_