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## Progress to Higher Mathematics

### Checklist of Learning Outcomes

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- I can find the points of intersection with the  $x$ -axis
- I can find the maximum and minimum values and corresponding values of  $x$

#### 7.5 page 58

- I can use graphs of the form  $y = \sin(x + r)^\circ + s$  or  $y = \cos(x + r)^\circ + s$
- I can find the equation from the graph
- I can find the point of intersection with the  $y$ -axis
- I can find the maximum and minimum values and corresponding values of  $x$

#### 7.6 page 61

- I can use graphs of the form  $y = p \sin(x + r)^\circ + s$  or  $y = p \cos(x + r)^\circ + s$
- I can find the equation from the graph
- I can find the maximum and minimum values and corresponding values of  $x$
- I can find the point of intersection with the  $y$ -axis

### Trigonometry

#### 8.1 page 63

- I can use the four-quadrant diagram to find angles with a given sine, cosine or tangent
- I can rearrange an equation to find the sine, cosine or tangent of an angle
- I can find the points of intersection of a trigonometric graph and a straight line by solving an appropriate equation

#### 8.2 page 64

- I can use the four-quadrant diagram to find angles with a given sine, cosine or tangent, and hence solve an equation
- I can rearrange an equation to find the sine, cosine or tangent of an angle
- I can find the points of intersection of a trigonometric graph and a straight line by solving an appropriate equation

#### 8.3 page 66

- I can use the exact values for the sine, cosine and tangent of  $30^\circ$ ,  $45^\circ$  and  $60^\circ$  to find exact values for the sine, cosine and tangent of negative angles and angles greater than  $90^\circ$
- I can use exact values to simplify expressions

#### 8.4 page 67

- I can use exact values for the sine, cosine and tangent of  $30^\circ$ ,  $45^\circ$  and  $60^\circ$  to solve equations

#### 8.5 page 68

- I can find the sine, cosine and tangent of an angle in a right-angled triangle, using Pythagoras' theorem where necessary

- I can calculate the value of other trigonometric ratios from the value of one ratio

#### 8.6 page 69

- I can use the identities  $\sin^2 x + \cos^2 x \equiv 1$  and  $\tan x \equiv \frac{\sin x}{\cos x}$

#### 8.7 page 70

- I can solve quadratic trigonometric equations
- I can solve a trigonometric equation by using the identity  $\sin^2 x + \cos^2 x \equiv 1$  to form a quadratic equation in  $\sin x$  or  $\cos x$

#### 8.8 page 71

- I can use graphs of the form  $y = p \sin(x + r)^\circ + s$  or  $y = p \cos(x + r)^\circ + s$
- I can find the maximum and minimum values and corresponding values of  $x$
- I can find the points of intersection with the  $x$ -axis
- I can find the point of intersection with the  $y$ -axis

### Algebra

#### 9.1 page 73

- I can use functional notation

#### 9.2 page 75

- I can construct an expression from given information
- I can use one expression in the construction of a second

#### 9.3 page 77

- I can form and solve linear equations
- I can form and solve quadratic equations
- I can solve word problems

#### 9.4 page 80

- I can multiply, divide and simplify expressions involving surds and indices
- I can rewrite an expression involving surds into one involving indices
- I can rewrite a fractional expression as a sum of separate terms, by dividing each term in the numerator by the denominator

### Preliminaries

#### 1.1 page 1

- I can rewrite an expression with brackets, by expanding the brackets and collecting like terms

#### 1.2 page 2

- I can solve linear equations with brackets, by expanding the brackets and then collecting terms together on one side of the equation
- I can solve linear equations with fractions, by multiplying each term by the same expression and then collecting terms together on one side of the equation

#### 1.3 page 2

- I can solve simultaneous equations given in various formats, using the method of substitution or the method of elimination

#### 1.4 page 3

- I can rewrite an expression with fractional terms in brackets, by expanding the brackets and collecting like terms
- I can rewrite a compound fractional expression as a simple fraction, by multiplying every term in the numerator and the denominator by the same expression

#### 1.5 page 4

- I can simplify expressions containing surds
- I can simplify an expression by division or by rationalising the denominator

#### 1.6 page 5

- I can evaluate fractional and negative indices
- I can simplify expressions containing indices

#### 1.7 page 6

- I can find exact values for the sine, cosine and tangent of  $30^\circ$ ,  $45^\circ$  and  $60^\circ$
- I can use exact values in simple problems

- I can find the exact value of the area of a triangle

### Solving equations

#### 2.1 page 8

- I can solve equations where the unknown occurs in a denominator
- I can remove the denominators by multiplying each term by the same expression

#### 2.2 page 8

- I can solve quadratic equations by factorising into the form  $(x - a)(x - b)$
- I can solve quadratic equations not in standard form by rearranging the terms

#### 2.3 page 9

- I can solve quadratic equations of the form  $ax^2 + bx + c = 0$  by factorising
- I can solve quadratic equations not in standard form by rearranging the terms

#### 2.4 page 10

- I can use a substitution in order to convert a more general equation into a quadratic equation
- I can solve the resulting quadratic equation and hence solve the original equation

#### 2.5 page 10

- I can solve equations of the form  $k(x - p)^2 = q$  by finding the square root of each side
- I can solve similar equations with a higher power by taking the appropriate root of each side

#### 2.6 page 11

- I can solve a cubic equation given in factorised form
- I can solve a cubic equation by factorising
- I can solve a cubic equation by rearranging and factorising

## Lines and circles

### 3.1 page 12

- I can find the gradient of the line joining two points
- I can find the gradient  $m$  of a line by converting the equation to the form  $y = mx + c$
- I can find the equation of a line through a given point with a given gradient, or through two given points
- I can find the points of intersection of a line with the  $x$ - and  $y$ -axes
- I can convert the equation of a line into a different form

### 3.2 page 13

- I can find and use equations of the form  $x = k$  for lines parallel to the  $y$ -axis
- I can find and use equations of the form  $y = l$  for lines parallel to the  $x$ -axis

### 3.3 page 14

- I can use the fact that parallel lines have equal gradients or that lines with equations of the form  $ax + by + c_1 = 0$  and  $ax + by + c_2 = 0$  are parallel
- I can find the equation of a line through a given point parallel to a given line

### 3.4 page 15

- I can find the midpoint of a line segment
- I can find the length of a line segment
- I can solve problems involving midpoints and lengths of line segments

### 3.5 page 16

- I can determine whether given points are collinear
- I can use properties of collinear points

### 3.6 page 17

- I can use the equation  $m = \tan \theta$  connecting the gradient  $m$  of a line and the angle  $\theta$  between the line and the positive  $x$ -axis

### 3.7 page 20

- I can use circle diagrams plotted in the coordinate plane
- I can use diameter and tangent properties of a circle

### 3.8 page 21

- I can calculate the distance between circles

## Graph sketching

### 4.1 page 23

- I can sketch the graph of a parabola with equation given in the form  $y = k(x - a)(x - b)$
- I can use the sign of  $k$  to find the shape of the curve
- I can label the  $y$ -intercept
- I can label the zeros
- I can sketch the graph of a parabola by factorising into the form  $y = k(x - a)(x - b)$

### 4.2 page 24

- I can sketch the graph of a parabola with equation given in the form  $y = k(x - p)^2 + q$
- I can use the sign of  $k$  to find the shape of the curve
- I can label the turning point
- I can label the  $y$ -intercept
- I can label the zeros

### 4.3 page 26

- I can sketch the graph of a cubic curve using the sign of the coefficient of  $x^3$  to find the shape of the curve
- I can label the  $y$ -intercept
- I can label the zeros

## Equations of curves

### 5.1 page 28

- I can find an equation of a parabola in the form  $y = kx^2 + q$  from a graph
- I can find  $q$  from the  $y$ -intercept or by moving the curve  $y = kx^2$  in a direction parallel to the  $y$ -axis
- I can find  $k$  by substituting the coordinates of a point on the curve into the equation
- I can check the sign of  $k$  from the shape of the curve

### 5.2 page 30

- I can find an equation of a parabola in the form  $y = k(x - a)(x - b)$  from a graph
- I can find  $a$  and  $b$  from the zeros

- I can find  $k$  from the  $y$ -intercept or by substituting the coordinates of a point on the curve into the equation

- I can check the sign of  $k$  from the shape of the curve

### 5.3 page 32

- I can write down the coordinates of the turning point of a parabola given in the form  $y = k(x - p)^2 + q$
- I can use the sign of  $k$  to determine the nature of the turning point

### 5.4 page 32

- I can find an equation of a parabola in the form  $y = k(x - p)^2 + q$  from a graph
- I can find  $p$  and  $q$  from the turning point
- I can find  $k$  from the  $y$ -intercept or by substituting the coordinates of a point on the curve into the equation
- I can check the sign of  $k$  from the shape of the curve

### 5.5 page 34

- I can find an equation of a parabola from the information given in a graph
- I can use the form  $y = k(x - a)(x - b)$  when the zeros are given
- I can use the form  $y = k(x - p)^2 + q$  when the turning point is given
- I can find an equation of the form  $y = ax^2 + bx + c$  by expanding brackets and collecting like terms

### 5.6 page 35

- I can change the equation of a parabola from the form  $y = k(x - a)(x - b)$  to the form  $y = k(x - p)^2 + q$
- I can use the axis of symmetry of a parabola
- I can find  $p$  and  $q$  from the turning point

### 5.7 page 38

- I can find an equation of a cubic curve in the form  $y = k(x - a)(x - b)(x - c)$  from a given graph
- I can find  $a$ ,  $b$  and  $c$  from the zeros
- I can find  $k$  from the  $y$ -intercept or by substituting the coordinates of a point on the curve into the equation

- I can check the sign of  $k$  from the shape of the curve

## Intersecting lines and curves

### 6.1 page 40

- I can find the point of intersection of two straight lines

### 6.2 page 43

- I can find the points of intersection of a straight line and a parabola

### 6.3 page 46

- I can find the points of intersection of two parabolas

### 6.4 page 49

- I can find the points of intersection of a straight line and a cubic curve

## Trigonometric graphs

### 7.1 page 51

- I can sketch the graphs  $y = \sin x$ ,  $y = \cos x$  and  $y = \tan x$
- I can use a sketch graph to solve simple trigonometric equations

### 7.2 page 52

- I can use graphs of the form  $y = p \sin qx^\circ$  or  $y = p \cos qx^\circ$
- I can find the equation from the graph
- I can find the points of intersection with the  $x$ -axis
- I can find the maximum and minimum values and corresponding values of  $x$

### 7.3 page 54

- I can use graphs of the form  $y = p \sin x^\circ + s$  or  $y = p \cos x^\circ + s$
- I can find the equation from the graph
- I can find the  $y$ -intercept (the point of intersection with the  $y$ -axis)
- I can find the maximum and minimum values and corresponding values of  $x$

### 7.4 page 56

- I can use graphs of the form  $y = p \sin(x + r)^\circ$  or  $y = p \cos(x + r)^\circ$
- I can find the equation from the graph