

## Lesson 8

**Additional Mathematics**  
**A-Level Pure Mathematics : Year 1**  
**Topics in Algebra**

### 8.1 Inequalities

*Any solution based entirely on graphical  
or numerical methods is not acceptable*

Marks Available : 45

#### “Together” Examples

Solve these inequalities:

( i )  $5x + 2 \leq 9$

( ii )  $7 - 3x \geq 13$

[ 1, 2 marks ]

( iii )  $-2 < 4x + 3 \leq 9$

( iv )  $\frac{4}{x} < \frac{5}{9}$

[ 2, 2 marks ]

This next question is where the focus falls in the A-Level course.

It's crucial to draw a graph in order to understand properly what is going on.

( v )  $x^2 - 2x - 15 < 0$

[ 3 marks ]

## 8.2 Exercise

*Any solution based entirely on graphical  
or numerical methods is not acceptable*

Marks Available : 45

### Question 1

Solve these inequalities;

( i )  $7x - 3 > 25$

( ii )  $13 - 4x < 11$

[ 1, 2 marks ]

( iii )  $3x - 5 > 19 - 5x$

( iv )  $3(2x + 3) - 4(x - 2) < 11$

[ 2, 2 marks ]

( v )  $17 + 7(x - 6) > 45$

( vi )  $13 < 5x + 3 < 21$

[ 2, 2 marks ]

( vii )  $-3 < 5 - 4x \leq 25$

( viii )  $\frac{10}{x} < \frac{5}{12}$

[ 2, 2 marks ]

**Question 2**

Solve these quadratic inequalities by;

- ☐ First factorising the quadratic into two pairs of brackets.
- ☐ Clearly stating the 'critical values' of the quadratic.
- ☐ Sketching the quadratic.
- ☐ Presenting your final solution with inequality signs clearly displayed.

( i )      $x^2 + 9x + 20 \leq 0$

( ii )      $x^2 + 3x - 18 < 0$

[ 4, 4 marks ]

(iii)  $x^2 + 13x + 12 > 0$

(iv)  $x^2 - 11x + 24 \geq 0$

[ 4, 4 marks ]

**Question 3**

The discriminant of the quadratic equation  $ax^2 + bx + c = 0$  is  $D = b^2 - 4ac$

Each of the following equations is to have two distinct real roots.  $\therefore D > 0$

By considering this inequality, find the range of  $k$  for each of the following,

( i )  $x^2 + 6x + k = 0$

( ii )  $kx^2 + 4x + 2 = 0$

[ 4, 4 marks ]

( iii )  $x^2 - 2x + k = 0$

( iv )  $kx^2 - 6x + 3 = 0$

[ 4, 4 marks ]

**Question 4**

Consider the following equation;

$$kx^2 - 2x + k = 0$$

This equation has two distinct real roots.

( i ) By considering the discriminant show that this implies,

$$(k - 1)(k + 1) < 0$$

[ 4 marks ]

( ii ) Hence state the range of values of  $k$ .

[ 4 marks ]

**Question 5**

- ( i ) By completing the square, write the algebraic expression

$$2x^2 - 28x + 87$$

in the form

$$a(x + b)^2 + c$$

where  $a$ ,  $b$  and  $c$  are numbers to be found.

[ 3 marks ]

- ( ii ) Hence show that the equation

$$2x^2 - 28x + 87 = 0$$

has solutions of the form

$$x = c \pm d\sqrt{22}$$

where  $c$  and  $d$  are numbers to be found.

[ 3 marks ]

This document is a part of a **Mathematics Community Outreach Project** initiated by Shrewsbury School

It may be freely duplicated and distributed, unaltered, for non-profit educational use

In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**"

© 2025 Number Wonder

Teachers may obtain detailed worked solutions to the exercises by email from [MHHShrewsbury@Gmail.com](mailto:MHHShrewsbury@Gmail.com)