Lesson 10

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

10.1 Past Paper Work

Topics in Algebra has looked at some "standard, routine techniques".
The next exercise is constructed entirely from old examination questions and shows how the material may be formally tested.

10.2 Exercise

Any solution based entirely on graphical
or numerical methods is not acceptable
Marks Available : 74

Question 1

A-Level Examination Question from January 2012, C1, Q3 (Edexcel)

Find the set of values of x for which

(a) $4x - 5 > 15 - x$

[2 marks]

(b) $x(x - 4) > 12$

[4 marks]

Question 2

A-Level Examination Question from June 2008, C1, Q2 (Edexcel)

Factorise completely,

$$x^3 - 9x$$

[3 marks]

Question 3

A-Level Examination Question from June 2009, C1, Q4 (Edexcel)

Find the set of values of x for which

(a) $4x - 3 > 7 - x$

[2 marks]

(b) $2x^2 - 5x - 12 < 0$

[4 marks]

(c) ***both*** $4x - 3 > 7 - x$ ***and*** $2x^2 - 5x - 12 < 0$

[1 mark]

Question 4

A-Level Examination Question from May 2010, C1, Q3 (Edexcel)

Find the set of values of x for which

(a) $3(x - 2) < 8 - 2x$

[2 marks]

(b) $(2x - 7)(1 + x) < 0$

[3 marks]

(c) ***both*** $3(x - 2) < 8 - 2x$ ***and*** $(2x - 7)(1 + x) < 0$

[1 mark]

Question 5

A-Level Examination Question from May 2010, C1, Q4 (Edexcel)

(a) Show that $x^2 + 6x + 11$ can be written as,

$$(x + p)^2 + q$$

where p and q are integers to be found.

[2 marks]

(b) Sketch the curve with equation $y = x^2 + 6x + 11$ showing clearly any intersections with the coordinate axes.

[2 marks]

(c) Find the value of the discriminant of $x^2 + 6x + 11$

[2 marks]

Question 6

A-Level Examination Question from June 2008, C1, Q8 (Edexcel)

Given that $2qx^2 + qx - 1 = 0$, where q is a constant, has no real roots,

(a) Show that $q^2 + 8q < 0$

[2 marks]

(b) Hence find the set of possible values of q

[3 marks]

Question 7

A-Level Examination question from May 2011, C1, Q7 (Edexcel)

$f(x) = x^2 + (k + 3)x + k$ where k is a real constant

(a) Find the discriminant of $f(x)$ in terms of k

[2 marks]

(b) Show that the discriminant of $f(x)$ can be expressed in the form $(k + a)^2 + b$ where a and b are integers to be found.

[2 marks]

(c) Show that, for all values of k, the equation $f(x) = 0$ has real roots.

[2 marks]

Question 8

A-Level Examination Question from January 2009, C1, Q7 (Edexcel)

The equation $k x^2 + 4x + (5 - k) = 0$, where k is a constant, has 2 different real solutions for x.

(a) Show that k satisfies, $k^2 - 5k + 4 > 0$

[3 marks]

(b) Hence find the set of possible values of k

[4 marks]

Question 9

A-Level Examination question from January 2007, C1, Q4 (Edexcel)

Solve the simultaneous equations

$$y = x - 2$$

$$y^2 + x^2 = 10$$

[7 marks]

Question 10

A-Level Examination Question from January 2008, C1, Q8 (Edexcel)

The equation $x^2 + kx + 8 = k$ has no real solutions for x

(a) Show that k satisfies $k^2 + 4k - 32 < 0$

[3 marks]

(b) Hence find the set of possible values of k.

[4 marks]

Question 11

A-Level Examination Question from January 2007, C1, Q5 (Edexcel)

The equation $2x^2 - 3x - (k + 1) = 0$, where k is a constant, has no real roots.
Find the set of possible values of k.

[4 marks]

Question 12

A-Level Examination Question from January 2010, C1, Q10 (Edexcel)

$f(x) = x^2 + 4kx + (3 + 11k)$ where k is a constant.

(a) Express $f(x)$ in the form $(x + p)^2 + q$, where p and q are constants to be found in terms of k

[3 marks]

Given that the equation $f(x) = 0$ has no real roots,

(b) Find the set of possible values of k.

[4 marks]

Given that $k = 1$,

(c) Sketch the graph of $y = f(x)$, showing the coordinates of any point at which the graph crosses a coordinate axis.

[3 marks]