

Higher Mathematics

Quadratics - Questions - 2013-2019

Marks are indicated in brackets after each question number

2013 Paper 1 Question 3, (2)

Calculate the discriminant of the quadratic equation  $2x^2 + 4x + 5 = 0$ .

2013 Paper 1 Question 19, (2)

Solve  $1 - 2x - 3x^2 > 0$ , where  $x$  is a real number.

2013 Paper 1 Question 21, (3)

Express  $2x^2 + 12x + 1$  in the form  $a(x + b)^2 + c$ .

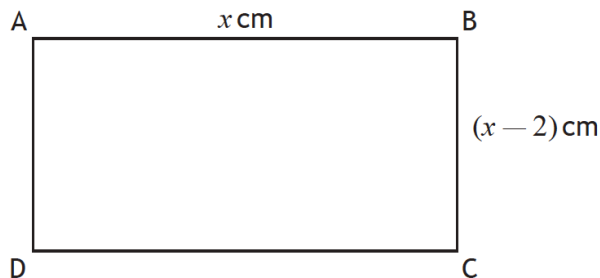
2014 Paper 1 Question 17, (2)

$3x^2 + 12x + 17$  is expressed in the form  $3(x + p)^2 + q$ .

What is the value of  $q$ ?

2015 Paper 1 Question 8, (4)

ABCD is a rectangle with sides of lengths  $x$  centimetres and  $(x - 2)$  centimetres, as shown.



If the area of ABCD is less than  $15 \text{ cm}^2$ , determine the range of possible values of  $x$ .

2015 Paper 1 Question 11, (4) (6)

$T(-2, -5)$  lies on the circumference of the circle with equation

$$(x + 8)^2 + (y + 2)^2 = 45.$$

- (a) Find the equation of the tangent to the circle passing through  $T$ .
- (b) This tangent is also a tangent to a parabola with equation  $y = -2x^2 + px + 1 - p$ , where  $p > 3$ .  
Determine the value of  $p$ .

2016 Paper 1 Question 12, (2) (3)

The functions  $f$  and  $g$  are defined on  $\mathbb{R}$ , the set of real numbers by

$$f(x) = 2x^2 - 4x + 5 \text{ and } g(x) = 3 - x.$$

- (a) Given  $h(x) = f(g(x))$ , show that  $h(x) = 2x^2 - 8x + 11$ .
- (b) Express  $h(x)$  in the form  $p(x + q)^2 + r$ .

2016 Paper 2 Question 2, (3)

Find the range of values for  $p$  such that  $x^2 - 2x + 3 - p = 0$  has no real roots.

2017 Paper 1 Question 4, (3)

Find the value of  $k$  for which the equation  $x^2 + 4x + (k - 5) = 0$  has equal roots.

2017 Paper 2 Question 4, (3) (2) (2)

- (a) Express  $3x^2 + 24x + 50$  in the form  $a(x + b)^2 + c$ .
- (b) Given that  $f(x) = x^3 + 12x^2 + 50x - 11$ , find  $f'(x)$ .
- (c) Hence, or otherwise, explain why the curve with equation  $y = f(x)$  is strictly increasing for all values of  $x$ .

2018 Paper 2 Question 4, (3)

Express  $-3x^2 - 6x + 7$  in the form  $a(x+b)^2 + c$ .

2018 Paper 2 Question 10, (4)

The equation  $x^2 + (m-3)x + m = 0$  has two real and distinct roots.

Determine the range of values for  $m$ .

2019 Paper 1 Question 2, (3)

The equation  $x^2 + (k-5)x + 1 = 0$  has equal roots.

Determine the possible values of  $k$ .

2019 Paper 2 Question 7, (3) (3)

(a) Express  $-6x^2 + 24x - 25$  in the form  $p(x+q)^2 + r$ .

(b) Given that  $f(x) = -2x^3 + 12x^2 - 25x + 9$ ,  
show that  $f(x)$  is strictly decreasing for all  $x \in \mathbb{R}$ .