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## Quadratics - Past Edexcel Exam Questions

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1. Given that

$$f(x) = x^2 - 6x + 18, \quad x \geq 0$$

- (a) Express  $f(x)$  in the form  $(x - a)^2 + b$  where  $a$  and  $b$  are integers. [3]

The curve  $C$  with equation  $y = f(x)$ ,  $x \geq 0$ , meets the  $y$ -axis at  $P$  and has a minimum point at  $Q$ .

- (b) Sketch the graph of  $C$ , showing the coordinates of  $P$  and  $Q$ . [4]

The line  $y = 41$  meets  $C$  at the point  $R$ .

- (c) Find the  $x$ -coordinate of  $R$ , giving your answer in the form  $p + q\sqrt{2}$ , where  $p$  and  $q$  are integers. [5]

**Question 10 - Jan 2005**

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2.

$$x^2 - 8x - 29 \equiv (x + a)^2 + b,$$

where  $a$  and  $b$  are constants.

- (a) Find the value of  $a$  and the value of  $b$ . [3]  
(b) Hence, or otherwise, show that the roots of

$$x^2 - 8x - 29 = 0$$

are  $c \pm d\sqrt{5}$ , where  $c$  and  $d$  are integers to be found. [3]

**Question 3 - May 2005**

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3.

$$x^2 + 2x + 3 \equiv (x + a)^2 + b,$$

- (a) Find the value of the constants  $a$  and  $b$ . [2]  
(b) Sketch the graph of  $y = x^2 + 2x + 3$ , indicating clearly the coordinates of any intersections with the coordinate axes. [3]

- (c) Find the value of the discriminant of  $x^2 + 2x + 3$ . Explain how the sign of the discriminant relates to your sketch in part (b). [2]

The equation  $x^2 + kx + 3 = 0$ , where  $k$  is a constant, has no real roots.

- (d) Find the set of possible values of  $k$ , giving your answer in surd form. [4]

**Question 10 - Jan 2006**

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4. On separate diagrams, sketch the graphs of

(a)  $y = (x + 3)^2$ , [3]

(b)  $y = (x + 3)^3 + k$ , where  $k$  is a positive constant. [2]

Show on each sketch the coordinates of each point at which the graph meets the axes.

**Question 3 - May 2006**

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5.

$$f(x) = x^2 + 4kx + (3 + 11k), \text{ where } k \text{ is a constant.}$$

- (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]

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

- (b) find the set of possible values of  $k$ . [4]

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]

**Question 10 - Jan 2010**

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6. (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]

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

- (c) Find the value of the discriminant of  $x^2 + 6x + 11$ . [2]

**Question 4 - May 2010**

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7. The curve  $C$  has equation  $y = x(5 - x)$  and the line  $L$  has equation  $2y = 5x + 4$ .

- (a) Use algebra to show that  $C$  and  $L$  do not intersect. [4]  
(b) Sketch  $C$  and  $L$  on the same diagram, showing the coordinates of the points at which  $C$  and  $L$  meet the axes. [4]

**Question 5 - Jan 2012**

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- 8.

$$4x - 5 - x^2 = q - (x + p)^2,$$

where  $p$  and  $q$  are integers.

- (a) Find the value of  $p$  and the value of  $q$ . [3]  
(b) Calculate the discriminant of  $4x - 5 - x^2$ . [2]  
(c) Sketch the curve with equation  $y = 4x - 5 - x^2$ , showing clearly the coordinates of any points where the curve crosses the coordinate axes. [3]

**Question 8 - May 2012**

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- 9.

$$4x^2 + 8x + 3 \equiv a(x + b)^2 + c$$

- (a) Find the values of the constants  $a$ ,  $b$  and  $c$ . [3]  
(b) Sketch the curve with equation  $y = 4x^2 + 8x + 3$ , showing clearly the coordinates of any points where the curve crosses the coordinate axes. [4]

**Question 10 - Jan 2013**

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10. Given that

$$f(x) = 2x^2 + 8x + 3$$

- (a) find the value of the discriminant of  $f(x)$ . [2]

- (b) Express  $f(x)$  in the form  $p(x + q)^2 + r$ , where  $p$ ,  $q$  and  $r$  are integers to be found. [3]

The line  $y = 4x + c$ , where  $c$  is a constant, is a tangent to the curve with equation  $y = f(x)$ .

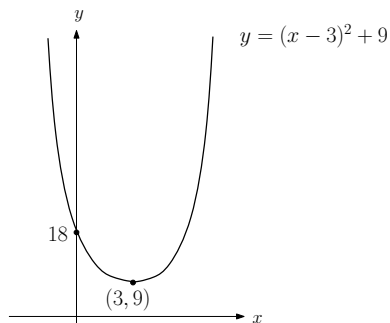
- (c) Calculate the value of  $c$ .

**Question 11 - Jun 2014**

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## Solutions

1. (a)  $a = 3, b = 9$



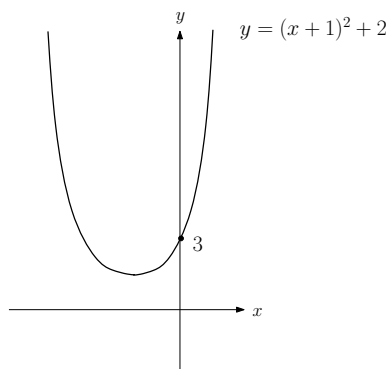
(b)

(c)  $3 + 4\sqrt{2}$

2. (a)  $a = -4, b = -45$

(b)  $c = 4, d = 3$

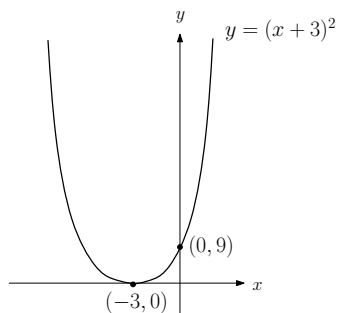
3. (a)  $a = 1, b = 2$



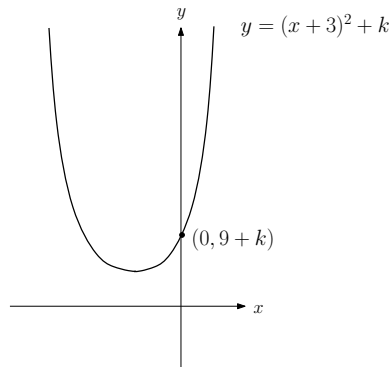
(b)

(c)  $b^2 - 4ac = -8 < 0$ , no roots

(d)  $-2\sqrt{3} < k < 2\sqrt{3}$



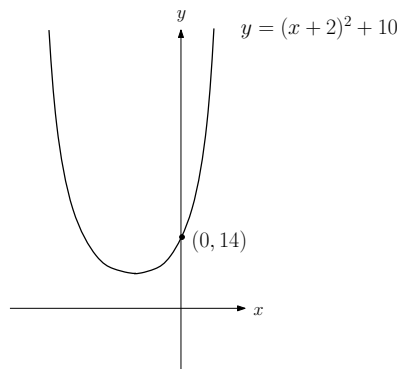
4. (a)



(b)

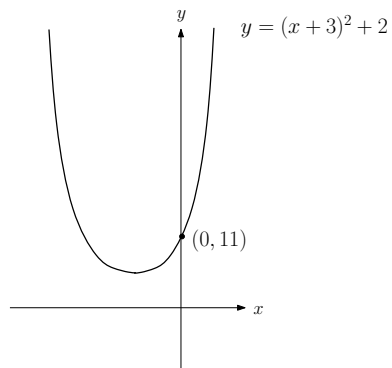
5. (a)  $p = 2k, q = 3 + 11k - 4k^2$

(b)  $-\frac{1}{4} < k < 3$



(c)

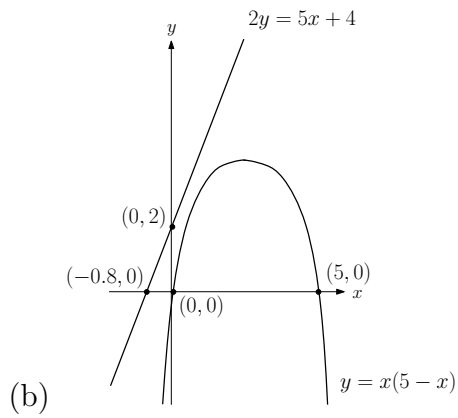
6. (a)  $p = 3, q = 2$



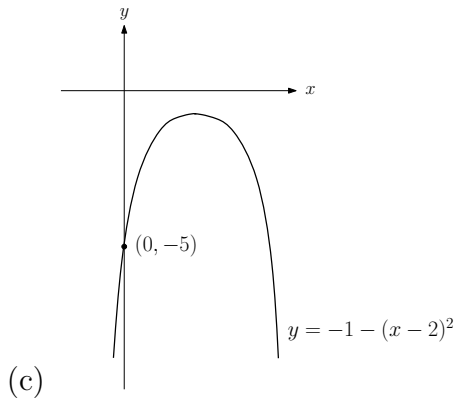
(b)

(c) -8

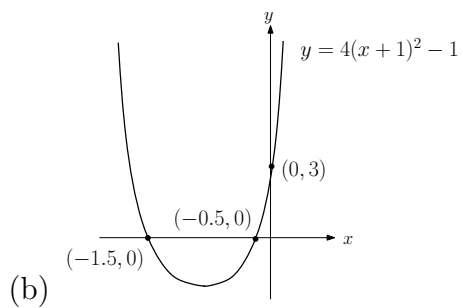
7. (a) -



8. (a)  $p = -2, q = -1$   
 (b) -4



9. (a)  $a = 4, b = 1, c = -1$



10. (a) 40  
 (b)  $p = 2, q = 2, r = -5$   
 (c)  $c = 1$