

## Chapter 2: Algebra

### 5th Year Test

6 November 2014



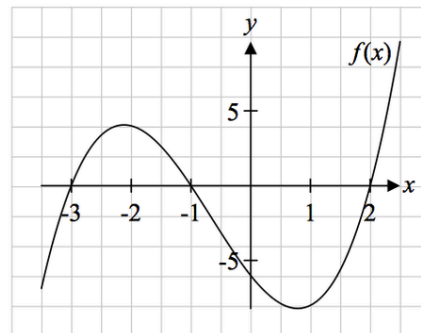
Student: \_\_\_\_\_

#### Question 1

- (a) The graph of a cubic function  $f(x)$  cuts the  $x$ -axis at  $x = -3$ ,  $x = -1$  and  $x = 2$ , and the  $y$ -axis at  $(0, -6)$ , as shown.

Verify that  $f(x)$  can be written as

$$f(x) = x^3 + 2x^2 - 5x - 6.$$



(b) Solve the simultaneous equations:

$$a^2 - ab + b^2 = 3$$

$$a + 2b + 1 = 0$$

**Question 2**

(a) Explain what it means to say that  $\sqrt{3}$  is not a rational number.

(b) Solve the equation  $x^2 - 2\sqrt{3}x - 9 = 0$ , giving your answers in the form  $a\sqrt{3}$ , where  $a \in \mathbb{Q}$ .

**Question 3**

- (a) The cubic function  $f : x \mapsto x^3 + 7x^2 + 17x + 15$  has one integer root and two complex roots. Find all three roots.

Write the quadratic equation  $x^2 + 4x + 1$  in the form  $(x - p)^2 + q$  and hence,

- (i) find the minimum point and minimum value of  $x^2 + 4x + 1$
- (ii) solve the equation  $x^2 + 4x + 1 = 0$ , leaving your answer in surd form.