"Complete the square." (Standard)

Question 1

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)

Question 2

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

Find the values of the constants a and b.

Question 3

$f(x) = x^2 - 8x + 19$

Express $f(x)$ in the form $(x + a)^2 + b$, where a and b are constants.

(2 marks)

Question 4

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

where a and b are constants.

Find the value of a and the value of b.

(3 marks)

Question 5

Given that $f(x) = 2x^2 + 8x + 3$, express $f(x)$ in the form $p(x + q)^2 + r$ where p, q and r are integers to be found.

(3 marks)

Question 6

Given that

$5x^2 + px - 8 = q(x - 1)^2 + r$

for all values of x, find the values of the constants p, q and r.

(4 marks)

Question 7

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

Find the value of p and the value of q.

(3 marks)

Question 8

Express $4 + 12x - 2x^2$ in the form $a(x + b)^2 + c$.

(4 marks)

Mark scheme

Question 1

$(x+3)^2+2$

$(x+3)^2+2$	or $p=3$ or $\frac{6}{2}$ $q=2$	B1 B1

Question 2

$a = 1, b = 2$

Question 3

$(x-4)^2+3$

$f(x)=(x-4)^2+3$	M1: $f(x)=(x\pm4)^2\pm\alpha$, $\alpha\neq0$ (where α is a single number or a numerical expression $\neq0$) A1: Allow $(x+^-4)^2+3$ and ignore any spurious "= 0"	M1A1
Allow a = -4, b = 3 to score both marks		

Question 4

$a = -4, b = -45$

$x^2-8x-29\equiv(x-4)^2-45$		$(x\pm4)^2$ $(x-4)^2-16+(-29)$ $(x\pm4)^2-45$	M1 A1 A1
ALT Compare coefficients	$-8=2a$ $a=-4$ AND $b=-45$	equation for a $a^2+b=-29$	M1 A1 A1

Question 5

$2(x+2)^2-5$

(b) $2x^2+8x+3=2(x^2+.....)$		or p=2	B1
$=2((x+2)^2\pm...)$		or $q=2$	M1
$=2(x+2)^2-5$		or $p=2$, $q=2$ and $r=-5$	A1

Question 6

$p = -10, q = 5, r = -13$

$5x^2 + px - 8 = 5(x-1)^2 + r$	B1
$= 5(x^2 - 2x + 1) + r$	
$= 5x^2 - 10x + 5 + r$	B1
$p = -10$	
$r = -13$	M1
	A1

Question 7

$p = -2, q = -1$

$4x - 5 - x^2 = q - (x-p)^2$, p, q are integers.	
$\{4x - 5 - x^2 =\} -[x^2 - 4x + 5] = -[(x-2)^2 - 4 + 5] = -[(x-2)^2 + 1]$	M1
$= -1 - (x-2)^2$	A1 A1

Question 8

$-2(x-3)^2 + 22$

$-2(x^2 - 6x - 2)$	**B1**
$= -2[(x-3)^2 - 2 - 9)]$	**B1**
	M1
$= -2(x-3)^2 + 22$	**A1**