Question 1

The equation $x^2 + (4k + 3)x + 2 = 0$, where k is a constant, has real roots.

(a) Show that k satisfies the inequality $16k^2 + 24k + 1 \geq 0$. (3 marks)

(b) Find the range of possible values for k, giving your boundaries as fully simplified surds. (4 marks)

Total: 7 marks

Question 2

The equation $k(2x^2 + 5x + 6) = 3 - 4x$, where k is a real constant, has real roots.

(a) Show that k satisfies the inequality $23k^2 - 64k - 16 \leq 0$. (4 marks)

(b) Find the range of possible values for k. (4 marks)

Total: 8 marks

Question 3

Find the range of values of k for which the quadratic equation $kx^2 + 6x + 3(k + 4) = 0$ has real roots.

Question 4

The function $f(x) = x^2 + bx + c$ has a minimum point at $(3, -2)$ and passes through the point $(0, 7)$.

(a) Find the values of b and c.

(4 marks)

Question 5

The equation $x^2 + 4px + 2p = 0$, where p is a constant, has no real roots.

(a) Show that p satisfies the inequality $16p^2 - 8p < 0$. (3 marks)

(b) Find the range of possible values for p. (2 marks)

Total: 5 marks