0 1 Given that a, b are integers, simplify the following. Show all your working.

a) $\dfrac{2\sqrt{3}+a}{\sqrt{3}-1}$ [3]

b) $\dfrac{2\sqrt{6b^2}}{\sqrt{2}}-\sqrt{27}+\sqrt{192}$ [3]

0 2 Find all the values of k for which the equation $x^2 + 2kx + 9k = -4x$ has two distinct real roots. [6]

0 3 Use an **algebraic method** to solve the equation $12x^3 - 29x^2 + 7x + 6 = 0$. Show all your working. [6]

0 4 The line L_1 passes through the points $A(-1, 3)$ and $B(2, 9)$. The line L_2 has equation $2y + x = 25$ and intersects L_1 at the point C. L_2 also intersects the x-axis at the point D.

a) Show that the equation of the line L_1 is $y = 2x + 5$. [3]

b) **i)** Find the coordinates of the point D.

ii) Show that L_1 and L_2 are perpendicular.

iii) Determine the coordinates of C. [5]

c) Find the length of CD. [2]

d) Calculate the angle ADB. Give your answer in degrees, correct to one decimal place. [4]

5. The circle C has centre A and radius r. The points $P(1, -4)$ and $Q(9, 10)$ are at either end of a diameter of C.

(a) (i) Write down the coordinates of A.

(ii) Show that $r = \sqrt{65}$.

(iii) Write down the equation of C. [4]

(b) Verify that the point $R(4, 11)$ lies on C. [2]

(c) Find $\hat{QPR}$. [3]

6. Differentiate **each** of the following with respect to x.

(a) $2x^5 + \frac{24}{x^2} - 3\sqrt{x}$ [3]

(b) $x^2(3x+1)$ [2]

7. (a) Express $x^2 + 4x + 9$ in the form $(x + a)^2 + b$, where the values of a and b are to be determined.
Deduce the maximum value of

$$\frac{1}{x^2+4x+9}.$$

[4]