$(x+2)$ is a factor of the polynomial $p(x) = x^3 + ax^2 + bx - 6$. Given that $p'(2) = 5$ find the values of a and b.

Evaluate $\int x \ln(x)\ \mathrm{d}x$

A region, R, is defined by $x^2 + x - 6 < y < 2x + 1$. Sketch a graph to show R, shading R.

Let m be a rational number and n be an irrational number. Prove by contradiction that $n + m$ is an irrational number.

Prove

$$\frac{\sin(3x) + \sin(7x)}{\cos(3x) - \cos(7x)} = \cot(2x)$$

Find the cartesian equation of the curve defined parametrically by

$$x = 3\cos(\theta) + 2$$
$$y = 3\sin(\theta) - 4$$

Show that $f(x) = x\mathrm{e}^x + \ln(x)$ has a root in the interval $[0,1/2]$. Use the Newton-Raphson method to approximate this root to 4.d.p.

Sketch the curve $y = x^2 - 4x + k$. Given that the equation $x^2 - 4x + k = 0$ has two real roots find the range of k.

A triangle ABC has $|BC| = 6$ and $|AB| = 5\sqrt{3}$. The angle $\angle ABC = \frac{\pi}{3}$. Find the area of the triangle and $|AC|$.

Prove that the sequence $u_n = 3 \times 4^{-n}$ is decreasing.

Find the stationary points of $f(x) = x\mathrm{e}^x - 3$.

Find the first 4 non-zero terms in the binomial expansion of $(1 - 4x)^{\frac{1}{7}}$. Use this to approximate $0.92^{\frac{1}{7}}$