The mean value of $f(x) = 2x^2 + x$ over the interval $[a, 8]$ is 61. Find a.

Find the 2×2 matrix transformation that represents a rotation of $90°$ anticlockwise about the origin.

Prove by induction
$$\sum_{r=1}^{n} r(r^2 + 3) = \frac{1}{4}n(n+1)(n^2 + n + 6)$$

Find the turning points of the rational function
$$y = \frac{x^2 + 5x + 6}{x^2 + 7x + 6}$$

Use calculus to find the shortest distance between the point $(1, 3, 2)$ and the line with equation
$$\mathbf{r} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ 1 \\ 2 \end{pmatrix}$$

Using Q2 sketch $y = \dfrac{x^2 + 5x + 6}{x^2 + 7x + 6}$ fully. Indicate any asymptotes and intersections with the axes.

The cubic $3x^3 + ax^2 + bx + 4$ has roots α, β and γ. Find
1) $\alpha + \gamma + \beta$
2) $\dfrac{1}{\alpha} + \dfrac{1}{\beta} + \dfrac{1}{\gamma}$

Prove that $(AB)^{-1} = B^{-1}A^{-1}$

Find the cartesian equation of the loci $|z - 2 + 3i| = 3$.
Sketch the locus of points satisfying $|z - 4i| = |z + 3|$

Draw the graph $r = 1 - 3\sin(\theta)$, $0 \le \theta < 2\pi$.

Use standard results to evaluate
$$\sum_{r=1}^{20} r^3 + 2r^2 - r$$

Solve the inequality $\dfrac{3}{x + 2} \le \dfrac{1}{x - 4}$