



The whole sheet is non calculator

- The line with equation  $2y = 3x + 5$  is perpendicular to the line with equation  $y = kx$ . What is the value of  $k$ ?
- A sequence is defined by the recurrence relation  $u_{n+1} = 0 \cdot 2u_n + 9$ ,  $u_5 = 11$ . What is the value of  $u_3$ ?
- The points P, Q and R are collinear. P is the point  $(-1, 6, 4)$ , Q is the point  $(2, 0, 13)$  and  $\overrightarrow{QR} = \begin{pmatrix} 2 \\ -4 \\ 6 \end{pmatrix}$ . Calculate the ratio in which Q divides PR.
- Solve  $2\cos x + 1 = 0$  for  $x$ , where  $\pi \leq x \leq \frac{3\pi}{2}$
- Given that the point R is  $(3, -1, 2)$ ,  $\overrightarrow{RS} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$  and  $\overrightarrow{RT} = 3\overrightarrow{RS}$  find the coordinates of T.
- If  $\cos x = \frac{-2}{5}$ , what is the value of  $\cos 2x$ ?
- If  $e^{4t} = 6$ , find an expression for  $t$ .
- The circle with equation  $x^2 + y^2 - 12x - 10y + k = 0$  meets the coordinate axes at exactly three points. What is the value of  $k$ ?
- Solve  $\log_2(3x + 7) = 3 + \log_2(x - 1)$ , where  $x > 1$ .
- The vertices of triangle ABC are  $A(-5, 7)$ ,  $B(-1, -5)$  and  $C(13, 3)$ 
  - Show that the equation of the altitude from C is  $x - 3y = 4$ .
  - Find the equation of the median from B.
  - Find the coordinates of the point of intersection of the altitude from C and the median from B.
- Functions  $f$  and  $g$  are defined on suitable domains by  $f(x) = 10 + x$  and  $g(x) = (1 + x)(3 - x) + 2$ 
  - Find an expression for  $f(g(x))$ .
  - Express  $f(g(x))$  in the form  $p(x + q)^2 + r$ .
  - Another function  $h$  is given by  $h(x) = \frac{1}{f(g(x))}$ . What values of  $x$  cannot be in the domain of  $h$ ?