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Mechatronics Engineering
19/ENG05/058

MAT102

1. $x^2 + y^2 - 5x - y + 4 = 0$ P(1, 0)

$x^2 - 5x + y^2 - y + 4 = 0$

Completing the squares

$\therefore (x - \frac{5}{2})^2 - \frac{25}{4} + (y - \frac{1}{2})^2 - \frac{1}{4} + 4 = 0$

$(x - \frac{5}{2})^2 + (y - \frac{1}{2})^2 = 5/2$

Recall;

$(x - x_1)^2 + (y - y_1)^2 = r^2$

Centre $(\frac{5}{2}, \frac{1}{2})$, $r = \sqrt{5}/2$

$\therefore$ gradient $= \frac{0 - \frac{1}{2}}{1 - \frac{5}{2}} = \frac{-\frac{1}{2}}{-3/2} = \frac{1}{3}$

gradient of target $= -3$

Equation of tangent

$y - y_1 = m(x - x_1)$

$y - 0 = -3(x - 1)$

$y = -3x + 3$

$3x + y - 3 = 0$

2. $x^2 + y^2 - 12x - 12y + 47 = 0$ at P(1, 0)

$x^2 - 12x + y^2 - 12y + 47 = 0$

Completing the squares

$(x-6)^2 - 36 + (y-6)^2 - 36 + 47 = 0$

$(x-6)^2 + (y-6)^2 = 25$

Recall;

$(x - x_1)^2 + (y - y_1)^2 = r^2$

Centre (6, 6) $r = \sqrt{25} = 5$

$\therefore$ gradient $= \frac{0 - 6}{1 - 6} = \frac{-6}{-5} = \frac{6}{5}$

gradient of tangent $= \frac{-5}{6}$

Equation of tangent

$(y - y_1) = m(x - x_1)$

$y - 0 = -\frac{5}{6}(x - 1) \times 6$

$6y = -5(x - 1)$

$6y = -5x + 5$

$5x + 6y - 5 = 0$

3 $x^2 + y^2 - 8x + 14y + 40 = 0$ at $P(1, 0)$

$x^2 - 8x + y + 14y + 40 = 0$

Completing the squares

$(x - 4)^2 - 16 + (y + 7)^2 - 49 + 40 = 0$

$(x - 4)^2 + (y + 7)^2 = 25$

Recall

$(x - x_1)^2 + (y - y_1)^2 = r^2$

Centre $(4, -7)$ $r = \sqrt{25} = 5$

gradient $= \frac{0 - (-7)}{1 - 4} = \frac{7}{-3} = -\frac{7}{3}$

Gradient of a tangent $= \frac{3}{7}$

Equation of tangent

$(y - y_1) = m(x - x_1)$

$7 \times y - 0 = \frac{3}{7}(x - 1) \times 7$

$7y = 3(x - 1)$

$7y = 3x - 3$

$-3x + 7y + 3 = 0$