

NAME: Ogunlana Omolara Abiodun

MATRIC NO: 19/ENG09/013

DEPARTMENT: Aeronautical Engineering

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$$1. \quad x^2 + y^2 + g(x_1 + x) + f(y_1 + y) + c = 0$$

comparing the equation

$$x^2 + y^2 + 2gx + 2fy + c = 0 \quad \text{with}$$

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

$$2gx = -5x$$

$$g = -5/2$$

$$2fy = -y$$

$$f = -1/2$$

$$x_1 = 1$$

$$y_1 = 0$$

$$\therefore (1)x + 0(y) + (-5/2)(1+x) + (-1/2)(0+y) + 4 = 0$$

$$= x + 0 + (-5/2) + (-5/2)x + 0 - 1/2y + 4 = 0$$

$$= x - 5/2 - 5/2x - 1/2y + 4 = 0$$

multiply through by 2

$$2x - 5 - 5x - y + 8 = 0$$

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

$$y = -3x + 3$$



$$2. \quad x x_1 + y y_1 + g(x_1 + x) + f(y_1 + y) + c = 0$$

Comparing with equation

$$x^2 + y^2 + 2gx + 2fy + c = 0 \quad \text{with}$$

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

$$2gx = -12x$$

$$g = -6$$

$$2fy = -12y$$

$$f = -6$$

$$x_1 = 1$$

$$y_1 = 0$$

$$\therefore x(1) + y(0) + (-6)(1+x) + (-6)(0+y) + 47 = 0$$

$$x + 0 - 6 - 6x - 6y + 47 = 0$$

$$x - 6 - 6x - 6y + 47 = 0$$

$$-5x - 6y + 41 = 0$$

$$-5x + 41 = 6y$$



$$3. \quad x_1 x + y_1 y + g(x_1 + x) + f(y_1 + y) + c = 0$$

Comparing with equation

$$x^2 + y^2 + 2gx + 2fy + c = 0 \quad \text{with}$$

$$x^2 + y^2 - 8x + 4y + 40 = 0$$

$$2gx = -8x$$

$$g = -4$$

$$2fy = 4y$$

$$f = 7$$

$$x_1 = 1$$

$$y_1 = 0$$

$$(1)(x) + (0)(y) + -4(x+1) + 7(y+0) + 40 = 0$$

$$x + 0 - 4x - 4 + 7y + 40 = 0$$

$$-3x + 7y + 36 = 0$$

$$7y = 3x - 36$$