

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

M1

Begins process to rearrange for y,

M1

e.g. $y^2 = 4 - (x - 2)^2$

$$y = \pm\sqrt{4x - x^2}$$

Since negative y's will yield a smaller xy,

M1

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

Expression to be maximised is,

M1

$$f(x, y) = xy$$

$$f(x) = x(4x - x^2)^{\frac{1}{2}}$$

M1

$$f'(x) = (4x - x^2)^{\frac{1}{2}} + \frac{x}{2}(4 - 2x)(4x - x^2)^{-\frac{1}{2}}$$

M1

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

M1

Begins process to solve,

e.g. $0 = 2(4x - x^2)^{\frac{1}{2}}(4x - x^2)^{\frac{1}{2}} + 4x - 2x^2$

$$2(4x - x^2) + 4x - 2x^2 = 0$$

M1

$$-4x^2 + 12x = 0$$

$$x^2 - 3x = 0$$

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

M1

$$x = 0 \text{ or } x = 3$$

M1

Need maximum value so discount $x = 0$

M1

If $x = 3, y = (4(3) - 3^2)^{\frac{1}{2}}$

Must discount
 $x = 0$

$$y = \sqrt{12 - 9} = \sqrt{3}$$

$$\text{Max } xy = 3\sqrt{3}$$

B1

[12]

[12 marks]