



Maxima and Minima 18.3 Q1(ix)

*Local Maximum value* =  $f(4)$

$$= 4\sqrt{32 - 4^2}$$

$$= 4\sqrt{32 - 16}$$

$$= 4\sqrt{16}$$

$$= 16$$

*Local minimum at*  $x = -4$ ;

*Local Minimum value* =  $f(-4)$

$$= -4\sqrt{32 - (-4)^2}$$

$$= -4\sqrt{32 - 16}$$

$$= -4\sqrt{16}$$

$$= -16$$

Maxima and Minima 18.3 Q1(x)

$$f(x) = x + \frac{a^2}{x}$$

$$\therefore f'(x) = 1 - \frac{a^2}{x^2}$$

$$f''(x) = \frac{2a^2}{x^3}$$

For maxima and minima,

$$f'(x) = 0$$

$$\Rightarrow 1 - \frac{a^2}{x^2} = 0$$

$$\Rightarrow x^2 - a^2 = 0$$

$$\Rightarrow x = \pm a$$

Now,

$$f''(a) = \frac{2}{a} > 0 \text{ as } a > 0$$

$\therefore x = a$  is point of minima

$$f''(-a) = \frac{-2}{a} < 0 \text{ as } a > 0$$

$\therefore x = -a$  is point of maxima

Hence,

$$\text{local max value} = f(-a) = -2a$$

$$\text{local min value} = f(a) = 2a.$$

$$f(x) = x\sqrt{2-x^2}$$

$$\begin{aligned}\therefore f'(x) &= \sqrt{2-x^2} - \frac{2x^2}{2\sqrt{2-x^2}} \\ &= \frac{2(2-x^2) - 2x^2}{2\sqrt{2-x^2}} \\ &= \frac{2-2x^2}{\sqrt{2-x^2}} \\ f''(x) &= \frac{\sqrt{2-x^2}(-4x) + \frac{(2-2x^2)2x}{\sqrt{2-x^2}}}{\left(\sqrt{2-x^2}\right)^2} \\ &= \frac{-\left(2-x^2\right)4x + 4x - 4x^3}{\left(2-x^2\right)^{\frac{3}{2}}}\end{aligned}$$

For maxima and minima,

$$\begin{aligned}f'(x) &= 0 \\ \Rightarrow \frac{2(1-x^2)}{\sqrt{2-x^2}} &= 0 \\ \Rightarrow x &= \pm 1\end{aligned}$$

Now,

$$\begin{aligned}f''(1) &< 0 \\ \Rightarrow x = 1 &\text{ is point of local maxima} \\ f''(-1) &> 0 \\ \Rightarrow x = -1 &\text{ is point of local minima}\end{aligned}$$

Hence,

$$\text{local max value} = f(1) = 1$$

$$\text{local min value} = f(-1) = -1.$$

Maxima and Minima 18.3 Q1(xii)

$$f(x) = x + \sqrt{1-x}$$

$$\therefore f'(x) = 1 - \frac{1}{2\sqrt{1-x}} = \frac{2\sqrt{1-x} - 1}{2\sqrt{1-x}}$$

$$\therefore f'(x) = \frac{2\sqrt{1-x} \left( \frac{-1}{\sqrt{1-x}} \right) + \frac{(2\sqrt{1-x} - 1)}{\sqrt{1-x}}}{4(1-x)}$$

For maxima and minima,

$$f'(x) = 0$$

$$\Rightarrow \frac{2\sqrt{1-x} - 1}{2\sqrt{1-x}} = 0$$

$$\Rightarrow \sqrt{1-x} = \frac{1}{2}$$

$$\Rightarrow x = 1 - \frac{1}{4} = \frac{3}{4}$$

Now,

$$f''\left(\frac{3}{4}\right) < 0$$

$$\Rightarrow x = \frac{3}{4} \text{ is point of local maxima}$$

Hence,

$$\text{local max value} = f\left(\frac{3}{4}\right) = \frac{5}{4}.$$

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