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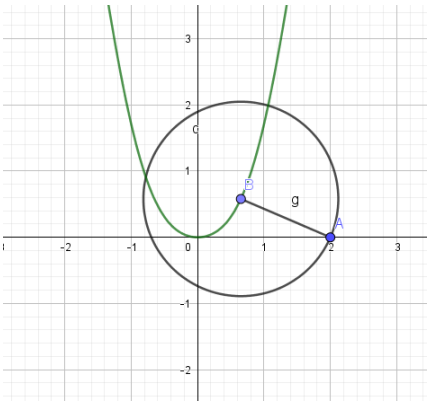
Computing Lab Assignment 5

Explanation of problem 3

In the problem we have given a curve f(x) = $x^2(1 + \sin^2 x)$. if we pass a circle of diameter "d" through this curve a pixel will illuminate if the centre of the pixel will inside or in circumference of the circle. To illuminate the pixel having centre (2,0), the circumference of the circle should pass through this point.



Now we have to calculate the stroke value which is AB i.e. the minimum distance between point (2,0) and given curve. Means the distance between point (x,f(x)) and (2,0).

Let "s" is the stroke then,

s = $\sqrt{(x-2)^2 + (f(x)-0)^2}$ .....eq(1)

let D = $s^2 = (x-2)^2 + (f(x))^2$ .....eq(2)

To get the minimum distance we differentiate the D with respect to "x" and equate it to zero.

$\frac{dD}{dx}$ = 2(x – 2) + 2f(x)f'(x) = 0

Now to calculate the roots of above equation we take-

g(x) = 2(x – 2) + 2f(x)f'(x)

Differentiating g(x) with respect to "x" –

g'(x) = 2 + 2{ f(x)f"(x) + f'(x)f'(x) }

Now, we will calculate the value of "x" by Newton Raphson method –

$$x_{n+1} = x_n - \frac{g(x)}{g'(x)}$$

After calculating the "x" , we can put it in equation (1) and can calculate the stroke value.

Diameter of circle – d = 2*s