

Pg 337 5,19,31

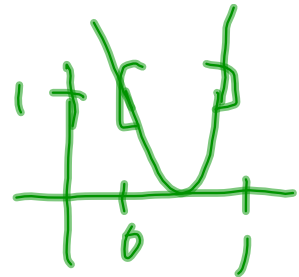
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$$5) f(x) = 4x^2 - 4x + 1 \quad [0, 1]$$

$$f'(x) = 8x - 4$$

$$\begin{aligned} 8x - 4 &= 0 \\ 8x &= 4 \\ x &= \frac{1}{2} \end{aligned}$$



Check
 $x = 0, 1, \frac{1}{2}$

$$f(0) = 1 \quad f(1) = 4 - 4 + 1 = 1$$

$$\begin{aligned} f\left(\frac{1}{2}\right) &= \frac{4}{4} - \frac{4}{2} + 1 \\ &= 0 \end{aligned}$$

max at $x = 0, 1$ max value = 1

min at $x = \frac{1}{2}$ min value = 0

$$19) \quad f(x) = x^3 - 3x - 2 \quad (-\infty, +\infty)$$

$$f'(x) = 3x^2 - 3$$

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

$$x^2 - 1 = 0$$

$$x = \pm 1$$

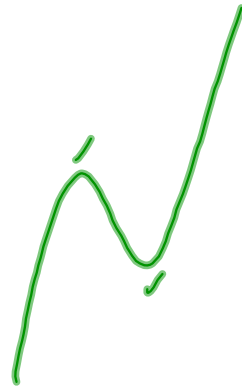
$$\lim_{x \rightarrow \infty} x^3 - 3x - 2 = \infty$$

no max

$$\lim_{x \rightarrow -\infty} x^3 - 3x - 2 = -\infty$$

no min

these are rel max/min

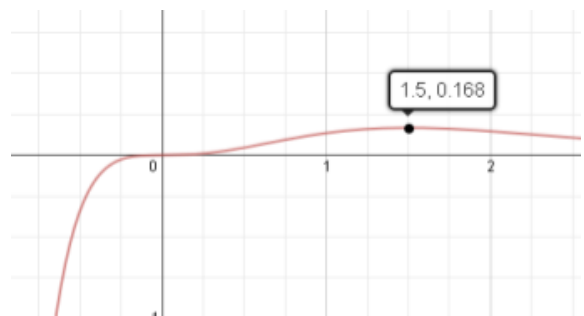


$$31) f(x) = x^3 e^{-2x} \quad [1, 4]$$

$$\begin{aligned} f'(x) &= x^3 e^{-2x} (-2) + e^{-2x} (3x^2) \\ &= e^{-2x} (-2x^3 + 3x^2) \\ &= e^{-2x} (x^2) (-2x + 3) \end{aligned}$$

$$f'(x) = 0 \Rightarrow$$

~~$x=0$~~ $x = \frac{3}{2}$



$$f(1) = 1 \cdot e^{-2} = 0.135$$

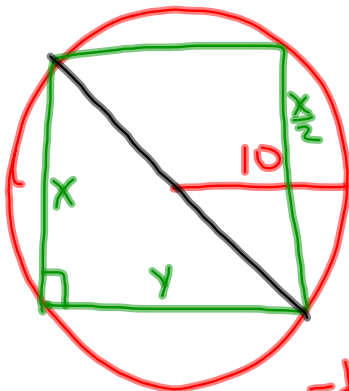
$$f\left(\frac{3}{2}\right) = \frac{27}{8} e^{-3} = 0.168$$

$$f(4) = 64 e^{-8} = 0.021$$

max

min

9)



$$\begin{aligned} A &= xy \\ x^2 + y^2 &= 20^2 \quad \leftarrow \text{key} \\ y^2 &= 20^2 - x^2 \\ y &= \sqrt{400 - x^2} \end{aligned}$$

$$\begin{aligned} A'(x) &= x \frac{1}{2} (400 - x^2)^{-\frac{1}{2}} (-2x) + \sqrt{400 - x^2} \cdot 1 \\ &= \frac{-x^2}{\sqrt{400 - x^2}} + \sqrt{400 - x^2} \end{aligned}$$

$$A'(x) = \frac{-x^2}{\sqrt{400-x^2}} + \sqrt{400-x^2} = 0 \quad ?$$

$$\frac{-x^2}{\sqrt{400-x^2}} = -\sqrt{400-x^2}$$

$$x^2 = 400 - x^2$$

$$2x^2 = 400$$

$$x^2 = 200$$

$$x = \sqrt{200}$$

$$x = 10\sqrt{2} \quad \text{def. } 45^\circ, \text{ square}$$

$$x \in [0, 20]$$

$$\text{at } 0 \quad A=0$$

$$\text{at } 20 \quad A=0$$

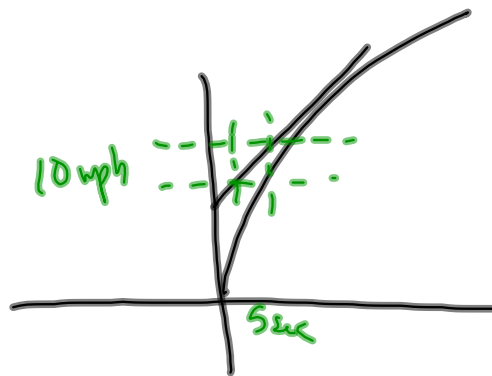
$$\begin{aligned} x^2 + y^2 &= 400 \\ (10\sqrt{2})^2 + y^2 &= 400 \\ y^2 &= 200 \\ y &= 10\sqrt{2} \end{aligned}$$

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- 1) a) vel \oplus acc \ominus slowing down
b) vel \oplus acc \oplus speeding up
c) vel \ominus acc \oplus slowing down

- 3) a) left
b) $s'' = a (-)$
c) speeding up vel & acc both $(-)$
d) slowing down pos curve is less steep

a)



$$a \approx \frac{10 \text{ mph}}{5 \text{ sec}} = 2 \text{ mph/s}$$

max acc $\Rightarrow t=0$
Steepest slope

$$\frac{\frac{\text{mi}}{\text{hr}}}{\text{s}} \rightarrow \frac{\frac{\text{ft}}{\text{s}}}{\text{s}} \rightarrow \frac{\text{ft}}{\text{s}^2}$$

17) $s(t) = -3t + 2$
 $s'(t) = v(t) = -3$
 $s''(t) = a(t) = 0$ constant speed

$s(0) = 2\text{m}$
 $v = -3\text{m/s}$
 $a = 0\text{m/s}^2$

object starts at position 2m and moves to the left at 3m/s. Notice that at $t=2$ $s(t)=-4$... in 2 seconds the object has travelled 6m to the left.