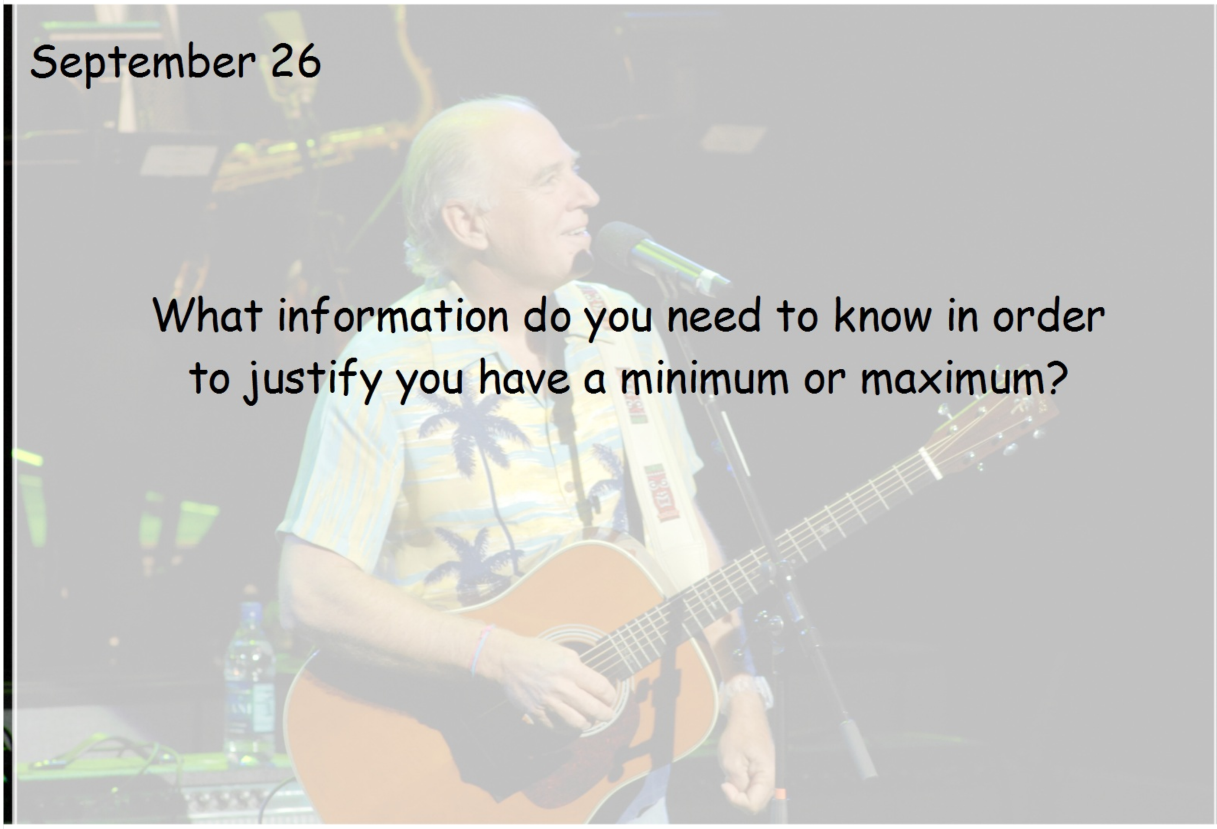


September 26

What information do you need to know in order to justify you have a minimum or maximum?

September 26

Students will verbally explain how to solve problems using derivatives and integrals

(using the words:
rate, amount, integral...)

The tide removes sand from Sandy Point Beach at a rate modeled by the function R, given by

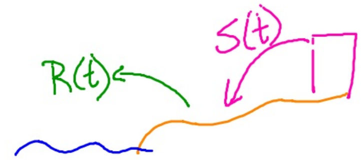
derivative → $R(t) = 2 + 5\sin\left(\frac{4\pi t}{25}\right)$. removing sand

A pumping station adds sand to the beach at a rate modeled by the function S, given by

derivative → $S(t) = \frac{15t}{1+3t}$. adding sand

Both $R(t)$ and $S(t)$ have units of cubic yards per hour and t is measured in hours for $0 \le t \le 6$. At time $t = 0$, the beach contains 2500 cubic yards of sand.

rate $= yd^3/hr$ t = hours



(0, 2500)

(hrs, yd^3)

(time, Amount of Sand)

(a) How much sand will the tide remove from the beach during this 6-hour period? Indicate units of measure.

Amount $t = 0 \to 6$

$$\int_0^6 R(t)\,dt = \int_0^6 2+5\sin\left(\frac{4\pi t}{25}\right)dt = 31.816\ yd^3$$

(b) Write an expression for $Y(t)$, the total number of cubic yards of sand on the beach at time t.

Amount bound $= t$

$$Y(t) = \int_0^t S(x)-R(x)\,dx + 2500$$

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$S(t) = \frac{15t}{1+3t}$.

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rate at 4

(c) Find the rate at which the total amount of sand on the beach is changing at time $t = 4$.

$$S(4) - R(4) = -1.909\ yd^3/hr$$

$$S(t) - R(t)\Big|_{t=4}$$

Domain

(d) For $0 \le t \le 6$, at what time t is the amount of sand on the beach a minimum? What is the minimum value? Justify your answers.

$t = ?$ derivative of Amount $= 0$

$$\frac{d}{dx}\left(\int_0^x S(t)-R(t)\,dt + 2500\right)$$

$$= [S(x)-R(x)](1) - [S(0)-R(0)](0) + 0$$

$$= S(x) - R(x)$$

$$0 = S(x) - R(x) \to S(x) = R(x)$$

$x = 5.118$

$A = 5.118$

Amount at $A = \int_0^A S(t)-R(t)\,dt + 2500 = 2492.693\ yd^3$

at $t = 0$, Amount $= 2500\ yd^3$

at $t = 6$, $= 2493.276\ yd^3$

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$$\frac{t^1}{t^{1/2}} = t^{1/2}$$

$$\int_1^{27} \frac{t+1}{\sqrt{t}}\,dt = \int_1^{27} \frac{t}{\sqrt{t}} + \frac{1}{\sqrt{t}}\,dt$$

$$= \int_1^{27} \sqrt{t} + \frac{1}{\sqrt{t}}\,dt = \int_1^{27} t^{1/2} + t^{-1/2}\,dt$$

59)

$F(4) = ?$

$F(1) = 3$

$F'(x) = x^2$

$$\int_a^b F'(x)\,dx = F(x)\Big|_a^b$$

$$= F(b) - F(a)$$

$$\int_1^4 x^2\,dx = F(4) - F(1)$$

$$\frac{x^3}{3}\Big|_1^4 = F(4) - 3$$

$$\frac{4^3}{3} - \frac{1^3}{3} = F(4) - 3$$