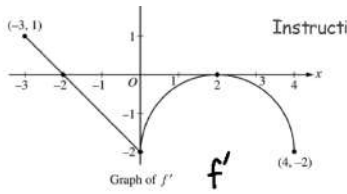
AP Calculus
Unit 6 Day 7 No Calculator!

Instruction

Let f be a function defined on the closed interval $-3 \le x \le 4$ with f f(0)=3. The graph of f', the derivative of f, consists of one line segment and a semicircle as shown.



f′

(a) On what intervals, if any, is f increasing? Justify your answer.

f is incr on $(-3,-2)$ b/c $f'>0$.

(b) Find the x-coordinate of each point of inflection of the graph of f on the open interval $-3 < x < 4$. Justify your answer.

f has POI when f′ changes from incr to dec or vice-versa

This occurs at $x=0$ and $x=2$.

(c) Find an equation for the line tangent to the graph of f at the point (0,3).

(d) Find f(-3) and f(4). Show the work that leads to your answers.

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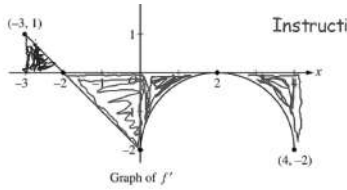

(c) Find an equation for the line tangent to the graph of f at the point (0,3).

$f'(0)=-2 \quad (0,3) \qquad y=3-2(x-0)$

(d) Find f(-3) and f(4). Show the work that leads to your answers. $f(0)=3$

$$\int_{-3}^{0} f'(x)\,dx = f(0)-f(-3) \qquad f(-3)=f(0)-\int_{-3}^{0} f'(x)\,dx$$

$$=3-\left[\tfrac{1}{2}(3)(1)+\tfrac{1}{2}(2)(-2)\right]=3-(1.5)=4.5$$

$$\int_{0}^{4} f'(x)\,dx = f(4)-f(0)$$

$$f(4)=f(0)+\int_{0}^{4} f'(x)\,dx = 3+\left[4(-2)+\tfrac{1}{2}\pi(2)^2\right]=3+(-8+2\pi)=3-8+2\pi=2\pi-5$$

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Powerpoint - Motion Examples

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Summary

Facts about motion...

1.) "at rest" $v(t) = 0$

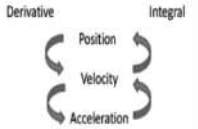
2.) direction change $v(t) = 0$ and v changes signs

3.) speed $|v(t)|$. If v(t) and a(t) have the same sign, speed is increasing. If they have different signs, speed is decreasing

4.) Moving right or up – v(t) >0 Moving left or down – v(t)<0

5.) Units – distance / time for velocity.

6.) Acceleration is the derivative of velocity. Units for acceleration - distance/ time^2



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4.) A particle moves along the y-axis so that it's velocity v at time $t \geq 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$. At time t=0, the particle is at y=-1. (Note: $\tan^{-1} x = \arctan x$). $s(0) = -1$

(A) Find the acceleration of the particle at time t=2.

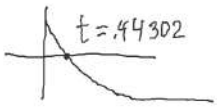
(B) Is the speed of the particle increasing or decreasing at time t=2? Give a reason for your answer.

(C) Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.

(2004 AB3)

a) $v'(2) = a(2) = -.1329$

b) $v(2) = -.4362$ Speed of particle is increasing b/c acc and vel at t=2 are the same sign.

c) 

$\int_0^{.44302} v(t)\,dt = \int_{.44302}^{.44302} s'(t)\,dt = s(.44302) - s(0)$

$.04678 = s(.44302) + (+1)$

$s(.44302) = .04678 - 1$

$= -.9532$ is the highest point the particle reaches

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(A) Find the acceleration of the particle at time t=2.

(B) Is the speed of the particle increasing or decreasing at time t=2? Give a reason for your answer.

(C) Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.

(2004 AB3)

(d) Find the position of the particle at time t=2. Is the particle moving toward or away from the origin at time t=2? Justify your answer.

$s(.44302) = -.9532$

$v(2) = -.4362$

$\int_{.44302}^{2} v(t)\,dt = s(2) - s(.44302)$

$-.40747 = s(2) + (.9532)$

$-1.36067 = s(2)$