~~Due Fri. 4/7:~~

- 2.4 #7-33 odd; 43-89 odd — Chain rule
- 5.1 #41-59 odd; 69,71 — Logarithmic functions

~~Due Mon. 4/10:~~

- 5.4 #33-51 odd; 59, 61 — Exponential functions
- 5.5 #37-69 odd — Log and exp functions with other bases
- 5.6 #39-63 odd — Inverse trig functions

~~TEST: Wed. 4/12?~~

Power Rule:
$\frac{d}{dx}[x^n] = nx^{n-1}$ d/dx [c]=0

Product Rule:
$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$

Constant Multiple Rule:
$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Quotient Rule:
$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{g^2(x)}$

Sum & Difference:
$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Chain Rule:
$\frac{d}{dx}[f(g(x))] = f'(g(x))g'(x)$

Trig Functions:

$\frac{d}{dx}[\sin x] = \cos x$ $\frac{d}{dx}[\tan x] = \sec^2 x$ $\frac{d}{dx}[\sec x] = \sec x \tan x$

$\frac{d}{dx}[\cos x] = -\sin x$ $\frac{d}{dx}[\cot x] = -\csc^2 x$ $\frac{d}{dx}[\csc x] = -\csc x \cot x$

Instantaneous rate of change of a function $f(x)$ when $x = c$ is $f'(c)$ <-- slope of tangent line through a single point

Average rate of change of a function $f(x)$ on the interval $[a, b]$ is $\frac{f(b)-f(a)}{b-a}$ <-- slope of secant line through two points

Given a position function $s(t) = gt^2 + v_0t + s_0$,

Since velocity is the rate of change of position,

The instantaneous velocity at time $t = c$ is $s'(c)$

The average velocity on the interval $[a, b]$ is $\frac{s(b)-s(a)}{b-a}$

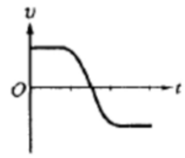
The Derivative

The slope of the tangent line to the graph of f at the point $(c, f(c))$ is given by:

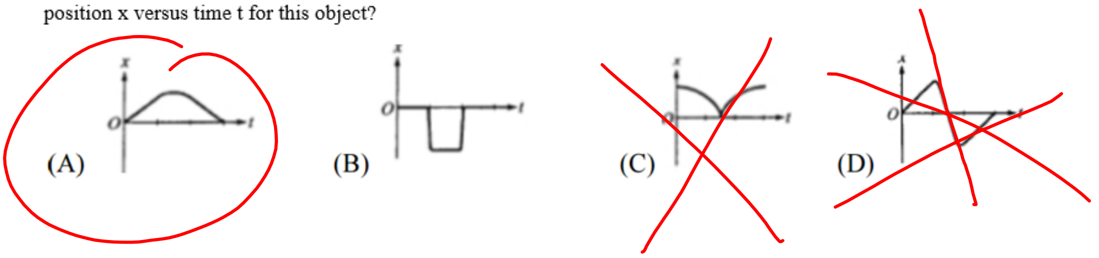
$$m = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{\Delta x \to 0} \frac{f(c + \Delta x) - f(c)}{\Delta x}$$

The derivative of f at x is given by

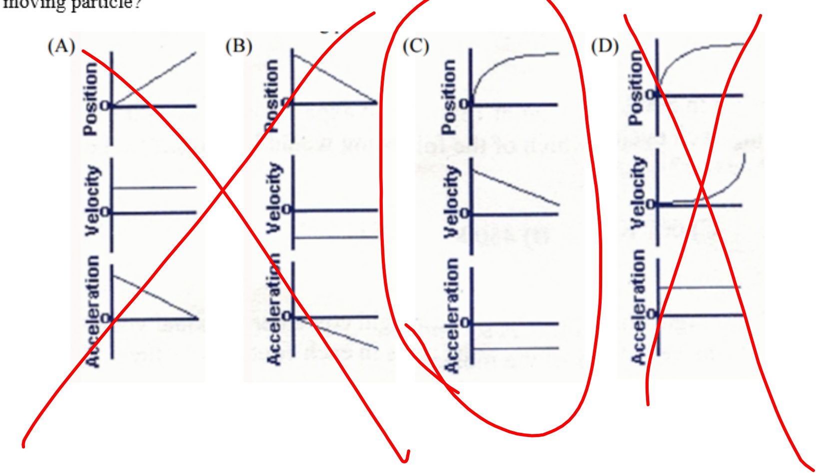
$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$



The graph above shows velocity v versus time t for an object in linear motion. Which of the following is a possible graph of position x versus time t for this object?

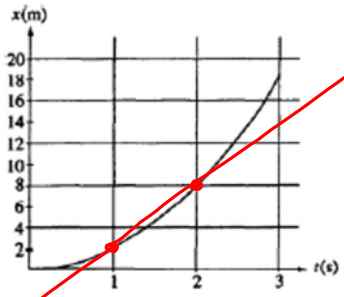


Which of the following sets of graphs below might be the corresponding graphs of position, velocity, and acceleration vs time for a moving particle?



speed = |velocity|

$V_{avg} = \frac{\Delta x}{\Delta t} = \frac{x(2)-x(1)}{2-1} = \frac{8-2}{2-1} = \frac{6}{1} = 6$



The graph above represents position x versus time t for an object being acted on by a constant force. The average speed during the interval between 1 s and 2 s is most nearly

(A) 2 m/s *(B) 4 m/s* *(C) 5 m/s* *(D) 6 m/s*

Consider the motion of an object given by the position vs. time graph shown below. For what time(s) is the speed of the object greatest?

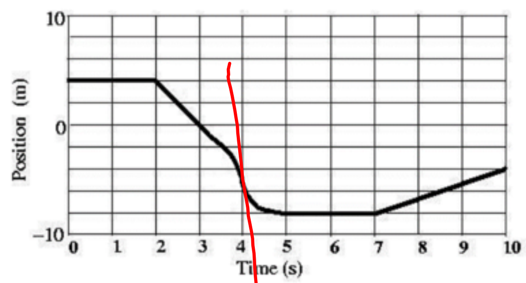
(A) At all times from t = 0.0 s→ t = 2.0 s 0

(B) At time t = 3.0 s |−4| = 4

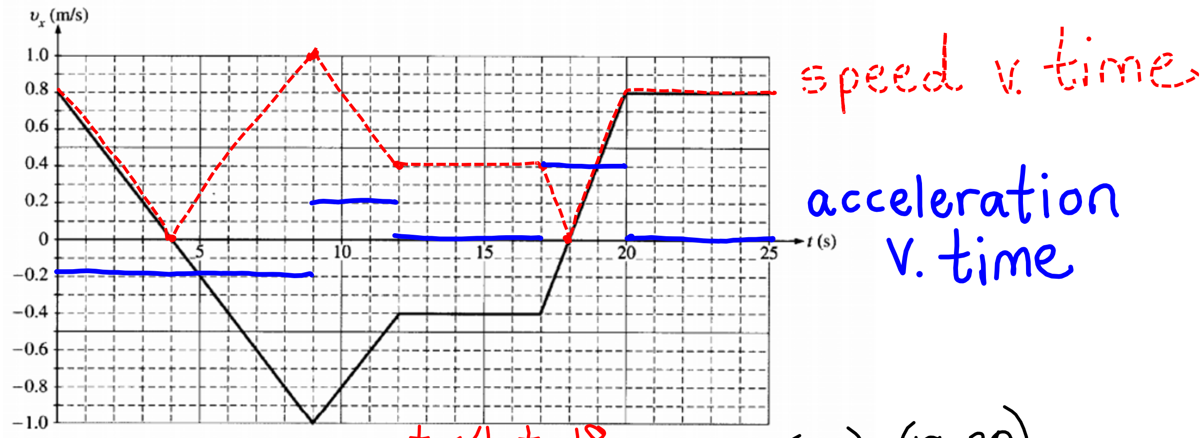
(C) At time t = 4.0 s big

(D) At all times from t = 5.0 s → t = 7.0 s 0

(E) At time t = 8.5 s $\frac{4}{3}$



2000B1 (modified) A 0.50 kg cart moves on a straight horizontal track. The graph of velocity *v* versus time *t* for the cart is given below.



a. Indicate every time t for which the cart is at rest. $t=4, t=18$

b. Indicate every time interval for which the speed (magnitude of velocity) of the cart is increasing. $(4,9)\cup(18,20)$

c. ~~Determine the horizontal position x of the cart at t = 9.0 s if the cart is located at x = 2.0 m at t = 0.~~

d. On the axes below, sketch the acceleration a versus time t graph for the motion of the cart from t = 0 to t = 25 s.

Find $y', y'', y''', y^{(4)}, y^{(5)}, \ldots, y^{(n)}$

$y = 5x^3 - 3x^2 + 2$

$y' = 15x^2 - 6x$

$y'' = 30x - 6$

$y''' = 30$

$y^{(4)} = 0$

$y^{(5)} = 0$

$y^{(6)} = 0$

$y = x^6 + 2x^5 - 3x^4 + 2x - 5$

$y' = 6x^5 + 10x^4 - 12x^3 + 2$

$y'' = 30x^4 + 40x^3 - 36x^2$

$y''' = 120x^3 + 120x^2 - 72x$

$y^{(4)} = 360x^2 + 240x - 72$

$y^{(5)} = 720x + 240$

$y^{(6)} = 720$

$y^{(7)} = 0$

$y^{(8)} = 0$

Find $y', y'', y''', y^{(4)}, y^{(5)}, \ldots, y^{(n)}$

$y = 5x^3 - 3x^2 + 2$ $y = x^6 + 2x^5 - 3x^4 + 2x - 5$

If $f(x)$ is a polynomial of degree n, then $f^{(n+1)}(x) = 0$.

If $f(x) = x^n$, then $f^{(n)}(x) = n! = n(n-1)(n-2)\cdots 3\cdot 2\cdot 1$

$f(x) = 3x^9 - 15x^4 + 23x^{16} - 201x^7 - 3$ $f^{(17)} = 0$