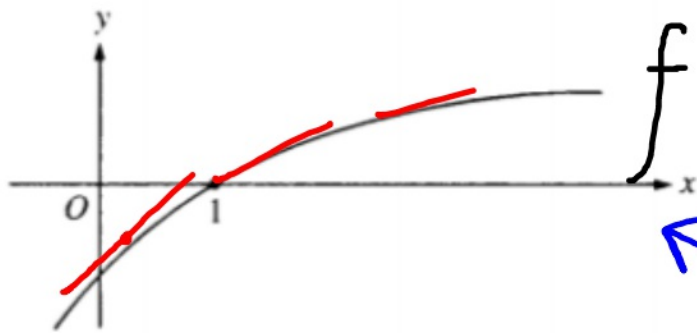


Are derivatives only applicable to particle motion?

No!

Rates of change, and rates of change *in* the rate of change is prevalent everywhere!





Rank from least to greatest

$$\boxed{f(1)} = 0$$

$$\boxed{f'(1)} \text{ (slope)} = +$$

$$\boxed{f''(1)} = -$$

$$f''(1) < f(1) < f'(1)$$

GARFIELD



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$$W(t) = +$$

$$W'(t) = +$$

$$W''(t) = -$$

$$-K \quad K$$

Atlanta Journal Constitution

13 DEC 2017

Torrid school enrollment rates cool off

By AUTHOR

tiabile desire for the creatures. The increase in Beijing-Ulanbataar trade is anticipated to relieve pressure on the relatively strained Russian suppliers, but increase Mongolia's imbalance of trade with its larger neighbour.

Historically the only competitor to China in the far eastern mose

year's figures. NASA stunned scientific community today with announcement of their discovery that the moon is significantly smaller than previously believed. This conclusion which is the conclusion of a 10-year collaborative project, will have profound implications for the mo

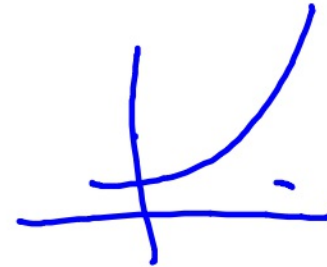
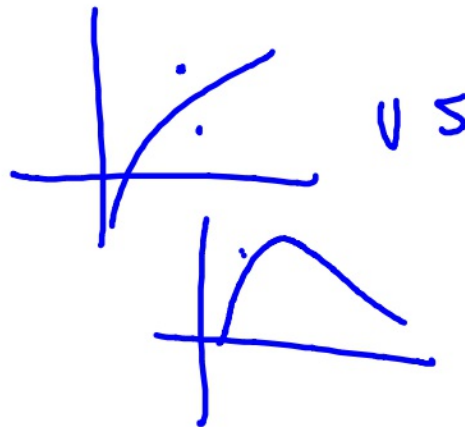
Pace Of U.S. Health Spending Slows In 2016

By Phil Galewitz
DECEMBER 6, 2017

 [REPUBLISH THIS STORY](#)



* $S(t) = +$
 $S'(t) = +$
 $S''(t) = -$



Chattanooga among top 25 cities for job growth this year

Employment in the Chattanooga area this year is growing more than three times as fast as the rest of the country, placing Chattanooga among the top cities for job growth in 2017, according to a new [study of employment trends by the web site 24/7 Wall Street](#).

From January through October, employers in the six-county Chattanooga metropolitan area added 9,377 net new jobs, boosting overall employment in the region by 3.8 percent. That ranked as the 21st best rate of job growth among all 388 metropolitan cities in the United States.

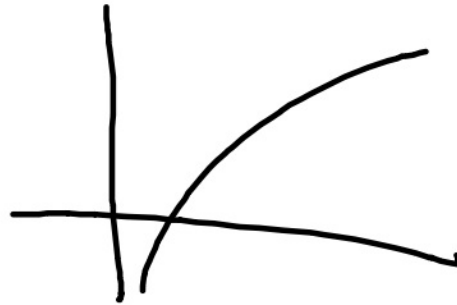
Chattanooga was among four Tennessee metro areas among the top 10 metro areas for job growth in the South so far in 2017. Overall, Tennessee's jobless rate fell this fall to 3 percent — the lowest level on record — and Chattanooga's unemployment rate fell in October to 3.5 percent — one of the lowest months in the past two decades.

Inmate numbers rise, but at slower rate

By Michael J. Sniffen
ASSOCIATED PRESS

WASHINGTON - The nation's federal and state prison population grew by nearly 60,000 in 1998, but declining crime rates helped reduce the rate of growth to the lowest level since 1979, the Justice Department reported yesterday.

The year-end figure included 1,178,978 state prisoners and 123,041 federal inmates for a total of 1,302,019, the department's Bureau of Justice Statistics said. That was up 4.8 percent from 1997 - below the average increase of 6.7 percent since 1990 and the lowest since the 2.3 percent growth in 1979.



News

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DELIVERY OF CARE

Decline in mortality rate amongst people with HIV has slowed in recent years



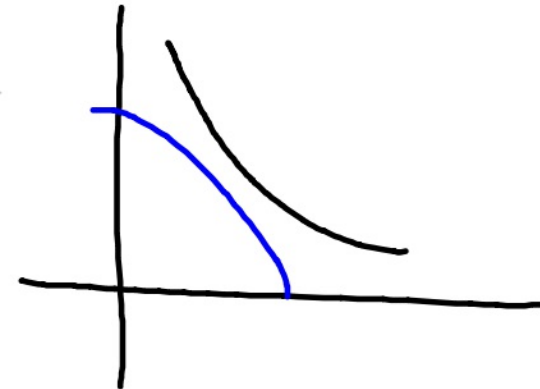
Michael Carter

Published: 02 October 2007

A study conducted by US investigators has found that although mortality has declined significantly in HIV-positive patients since the introduction of effective anti-HIV therapy, the rate of this decline has slowed in recent years. Their study, published in the October edition of *AIDS* also showed that noninfectious diseases, like heart and liver disease, are an increasingly important cause of death in HIV-positive patients.

Effective anti-HIV therapy became widely available in 1996 and brought about an immediate and dramatic fall in AIDS-related deaths. Improved treatment for opportunistic infections, the development of new antiretroviral drugs, and the evolution of HIV treatment guidelines have further contributed to falling mortality amongst HIV-infected patients.

Tweet



Average Global Temperature

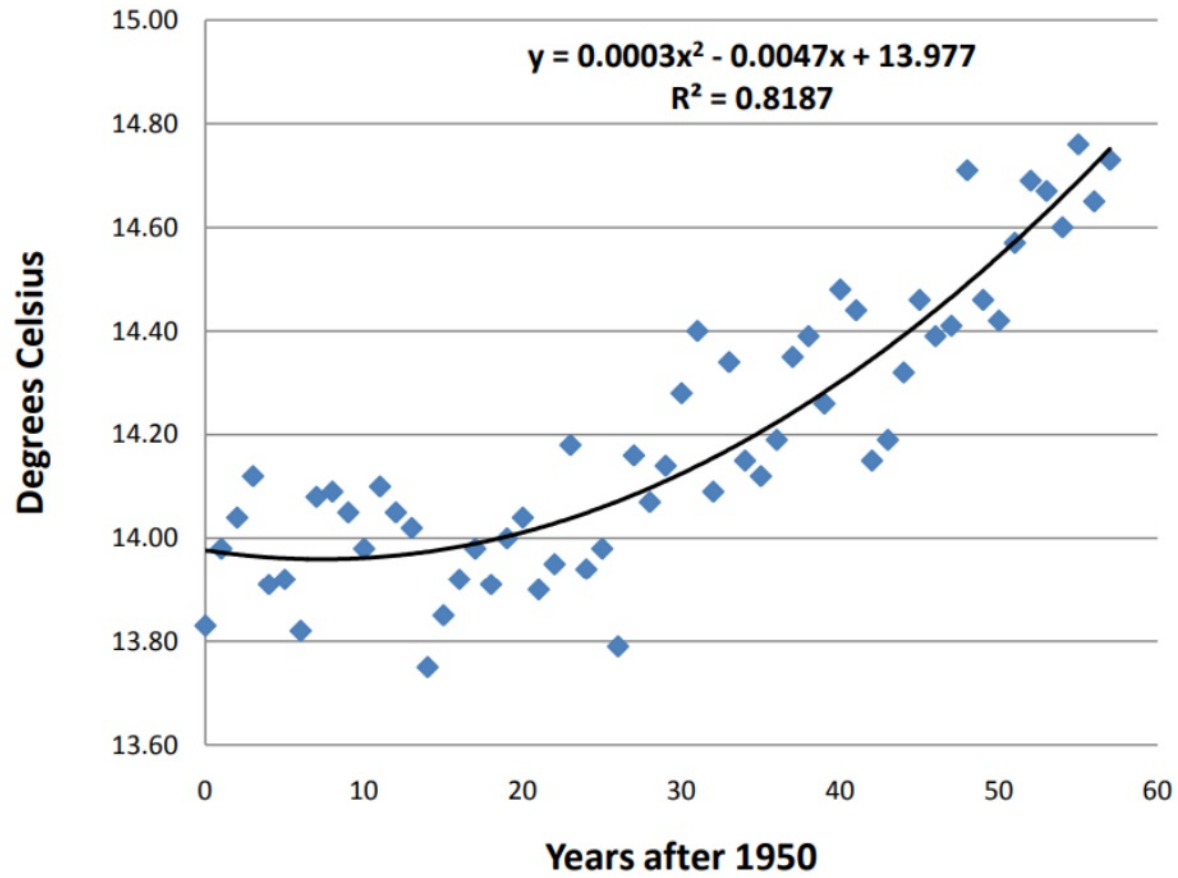


Figure 1 A scatter plot to and a quadratic fit to average global temperature data.

SHOE



(Used with permission of Chris Cassatt)

A tank is being drained. The volume, W , in liters, of liquid in the tank, for any time t in minutes is given by the model $W(t) = 120(0.5)^t$

Explain, using the correct units, the meaning of:

$$W(2) = 30$$

@ 2 min,
there are 30L
in the tank.

$$W'(3) = -10.397$$

$$\left. \frac{dW}{dt} \right|_{t=3} = -10.397 \frac{\text{L}}{\text{min}}$$

@ $t = 3$, the
vol. in the
tank is dec.
@ -10.397 L/min

$$W''(4) = 3.603$$

$$\left. \frac{d^2W}{dt^2} \right|_{t=4} = 3.603 \frac{\text{L}}{\text{min}^2}$$

@ $t = 4$, the rate
at which water is
drained is increasing
by 3.603 L/min/min

A company has developed a profit model for their new production line. The amount of profit P , in thousands of dollars, for widgets, w , they sell is given by $P(w) = -2w^3 + 3w^2 + 3$

Explain the meaning, using correct units:

$$P(1) = 4$$

If selling 1 widget, the profit is \$4,000.

$$\left. \frac{dP}{dw} \right|_{w=1.5} = \underline{-4.5}$$

If selling 1.5 widgets, the profit decreases by -\$4,500 per item.

$$\left. \frac{d^2P}{dw^2} \right|_{w=1} = -6$$

If selling 1 widget, the profit rate is decreasing by \$6,000.

P gives the lion population at a certain game reserve t years after the reserve was established.

P is lions, t is years
What is the best interpretation for the following statement?

The value of the derivative of P at $t = 6$ is equal to 12.

Choose 1 answer: $P'(6) = 12$

$\frac{P}{t}$

(A) After 6 years, the lion population grows at a rate of 12 lions.

(B) After 6 years, the lion population grows at a rate of 12 lions per year.

(C) The lion population grows at a rate of 12 lions per 6 years.

(D) After 6 years, there were 12 lions in the reserve. $P(6) = 12$

The function C gives the cost, in dollars, to shred w pounds of confidential documents of a company.

What is the best interpretation for the following statement?

$$C'(500) = 80$$

$$\frac{dC}{dw} \Big|_{w=500} = 80 \frac{\$}{lb}$$

Choose 1 answer:

(A) The cost to shred documents, when the weight of the documents is 500 pounds, is increasing at a rate of \$80 per pound.

(B) The average cost to shred documents is $\frac{80}{500}$ dollars per pound. ?

(C) The cost to shred 500 pounds of documents is \$80. $C(500) = 80$

(D) The cost to shred documents, when the weight of the documents is 500 pounds, is increasing at a rate of \$80. *wrong unit*

1. The position, in feet, of a particle moving along a straight path is given by the differentiable function $x(t) = \sin 2t - \cos 4t$ where t is measured in seconds. Find the acceleration of the particle at $t=0$. Include units in your answer.

$$\begin{aligned}
 v(t) &= \cos(2t) \cdot 2 + \sin(4t) \cdot 4 \\
 a(t) &= 2\cos(2t) - \sin(2t) \cdot 2 \\
 &\quad 4\sin(4t) - \cos(4t) \cdot 4
 \end{aligned}$$

$$2(\cos(2t) + 4\sin(4t))$$

$$4\cos(2t) - 2\sin(2t)$$

$$-2\sin(2t) \cdot 2$$

$$a$$

2. The position, in feet, of a particle moving along a straight path is given by the differentiable function $s(t) = -t^3 + 5t^2 - 7t + 3$. Find all times t where the particle is at rest.

$$\begin{aligned}
 v(t) &= -3t^2 + 10t - 7 \\
 a(t) &= -6t + 10
 \end{aligned}$$

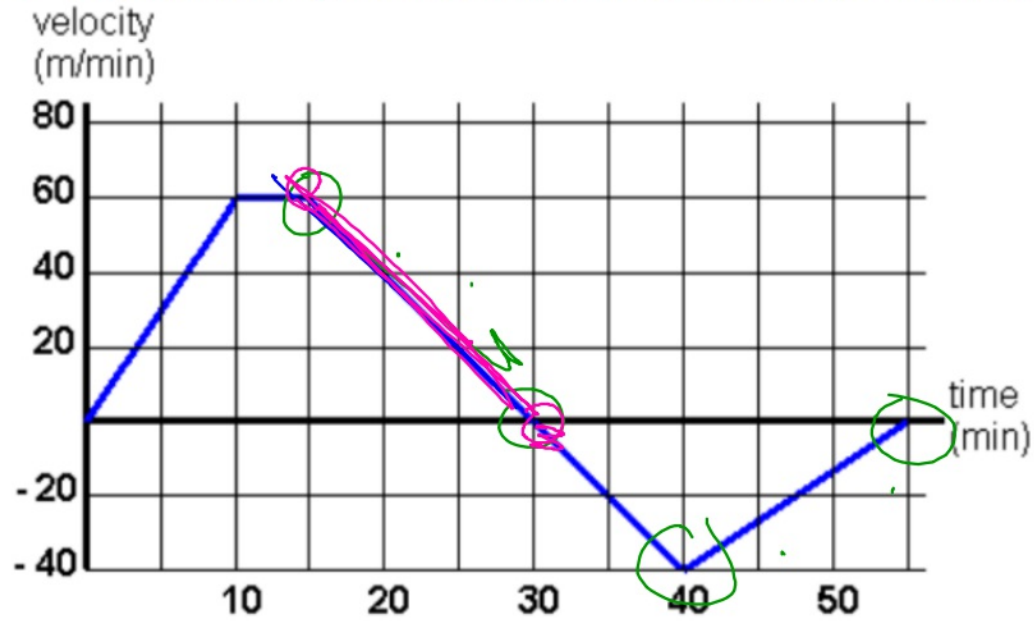
$$-4\sin(2t) + 4\cos(4t)$$

$$-4\sin(2t) + 16\cos(4t)$$

$$-4(0) + 16(1)$$

$$16 \text{ ft/s}^2$$

3. A person is hiking in a national park and their velocity in meters per minute is graphed below.



When does the person change direction?

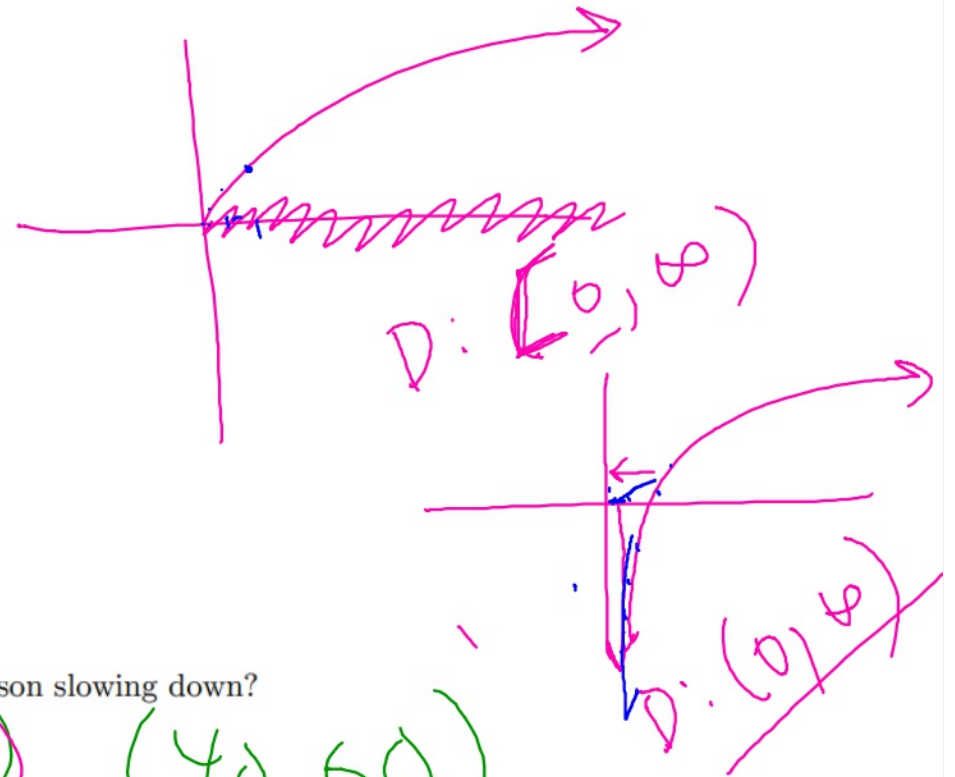
30!

When is the person walking at their greatest speed?

When is the person slowing down?

$(15, 60)$ $(40, 60)$

Calculate the acceleration at $t=20$ min.



D-AD18

10. Use a tangent line to approximate the value of $\sqrt[3]{29}$

$\sqrt[3]{27} = 3 \quad (27, 3) \quad f(x) = \sqrt[3]{x} \rightarrow f'(x) = \frac{1}{3} x^{-\frac{2}{3}}$

$y - 3 = \frac{1}{27} (29 - 27) \quad m = f'(x) = \frac{1}{3} x^{-\frac{2}{3}}$

$f'(27) = \frac{1}{3 \sqrt[3]{27^2}} \rightarrow \frac{1}{3 \sqrt[3]{729}} \quad \frac{1}{3 \cdot 9} = \frac{1}{27} = m$

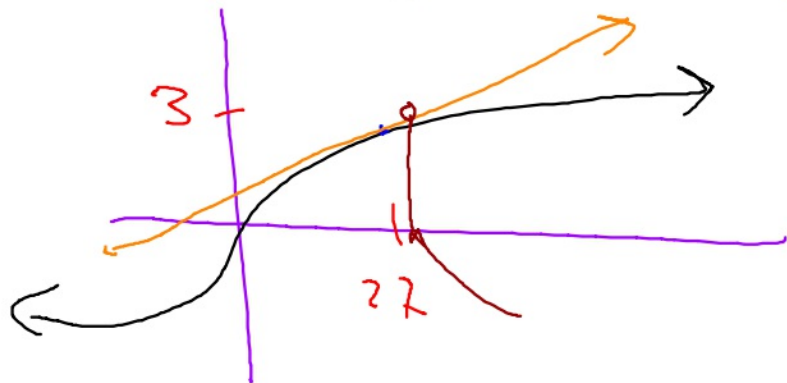
$y - 3 = \frac{1}{27} (2)$

$y - 3 = \frac{2}{27}$

$+3 \quad +3$

$y = \frac{83}{27} \rightarrow \sqrt[3]{\frac{83}{27}}$

11. Use a tangent line to approximate the value of $\cos \frac{\pi}{5}$. [Note: $\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$]



D-CD5

12. Find the x-values of any horizontal and vertical tangents to $f(x) = x^4 - 8x^2 + 2$.

$$4x^3 - 16x = 0$$

H.T
 $x = 0, -2, +2$

NO V.T

$$4x(x+2)(x-2) = 0$$

13. Find the x-values of any horizontal and vertical tangents to $y = 2\sqrt{x} - \frac{1}{2}x^2$

V.T ~~$x = 0$~~

H.T

$$y' = x^{-1/2} - x$$
$$y' = \frac{1 - x^{3/2}}{\sqrt{x}}$$
$$y' = \frac{1}{\sqrt{x}} - x = 0$$
$$\frac{1}{\sqrt{x}} - \frac{x}{1} \neq \frac{1-x}{\sqrt{x}}$$

$\frac{1-x^{3/2}}{\sqrt{x}}$