If the return is $f(x) = 1.17x + 1.51$ percent where x is the risk measured in beta, and if the dj industrial average is $d(f) = 0.0065f - 90.8182$ dollars where f is the percent return, what is the dj industrial average y in dollars in terms of the risk?

a. y = 0.007605x – 104.747294
b. none of these
c. y = 1.1765x – 89.3082
d. y = 0.007605x – 90.808385
e. $y = \dfrac{1.17x + 151}{0.0065x - 90.8182}$

function	input	output
f	risk β	% return
d	% return	$

$$y = d(f(x))$$
$$= d(1.17x + 1.51)$$
$$= 0.0065(1.17x + 1.51) - 90.8182$$
$$= 0.007605x - 90.808385$$

In 2000, the Agglet population had reached 6.78 million. The Agglet population is still increasing by 0.43 million per year. What is the rate of change of the Agglet population?

$$\frac{0.43 \text{ million Agglets}}{\text{year}} \quad \text{or} \quad \frac{430000 \text{ agglets}}{\text{year}}$$

The amount of an investment of P dollars with interest compounded continuously is modeled by the equation $A(t) = Pe^{0.075t}$ dollars t years after the initial investment. To two decimal places, how many years would it take this investment to double?

a. 7.74 years
b. 9.24 years
c. none of these
d. 1.86 years
e. 7.50 years

double of P dollars is 2 P dollars

$$2\cancel{P} = \cancel{P}e^{0.075t}$$

$$\ln 2 = 0.075t$$

$$\frac{\ln 2}{0.075} = t$$

$$t \approx 9.241962407$$

If $f(t)$ is the average person's consumption of water in liters based upon the temperature t in degrees F during an Aggie football game, interpret

$\frac{df}{dt}$ when t = 114.

$\frac{df}{dt}$ when $t = 114$ is the rate of change in liters of water consumed by the average person when the temperature is 114 °F.

For the next three problems: The table shows the number of wild horses in a wilderness area in certain years.

t years after 1890	0	5	10	12	13	L_1
Year	1890	1895	1900	1902	1903	
Horses	900	1645	3000	3820	4300	L_2

← or could use year as L_1

There are two models that we should consider for this data. Besides exponential, what other model should we consider? Circle one.

a. Logistic
b. None of these
c. Linear
d. Quadratic
e. Logarithmic

If we use an exponential model, what is the percentage change to two decimal places?

a. 12.79%
b. 900.50%
c. 1.13%
d. 0.13%
e. none of these

ExpReg L_1, L_2, Y_1

* $Y_1 = f(t) = 900.4994512(1.127888336^t)$ is the number of wild horses t years after 1890 for $0 \le t \le 13$.

percentage change is $(b-1)100\%$ so $(1.127888336 - 1)100\% \approx 12.79\%$

or * $g(x) = (1.484376)(10^{-96})(1.127888336^x)$ is the number of wild horses where x is the year for $1890 \le x \le 1903$.

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Use the exponential model to estimate the number of wild horses, to the nearest horse, in the wilderness area in 1898.

a. 2091
b. none of these
c. 2660
d. 2381
e. 2358

$Y_1(8) \approx 2358$

(if used year then $Y_1(1898) \approx 2358$)

Show your work when calculating the following.

$$\lim_{x \to -5} \frac{x^2 - 25}{x + 5} = \lim_{x \to -5} \frac{\cancel{(x+5)}(x-5)}{\cancel{x+5}} = \lim_{x \to -5} (x-5) = -5-5 = -10$$

The number of grams of dye per pound of chemical used to treat seed is $g(t) = 1.2t^2 + 0.36t + 6.15$ where t is the t^{th} hour of production, $1 \le t \le 8$.

The number of 20-pound batches of chemical produced is $p(t) = 1240(0.95^t)$ where t is the t^{th} hour, $1 \le t \le 8$. Which of the following function combinations needs to be performed to find the equation for the model of the hourly number of grams of dye needed.

a. $g(p(t))$

b. $\dfrac{g(t)}{20p(t)}$

c. $g(t)[20p(t)]$

d. $p(g(t))$

e. $g(t) \cdot p(t)$

f. $g(t) + 20p(t)$

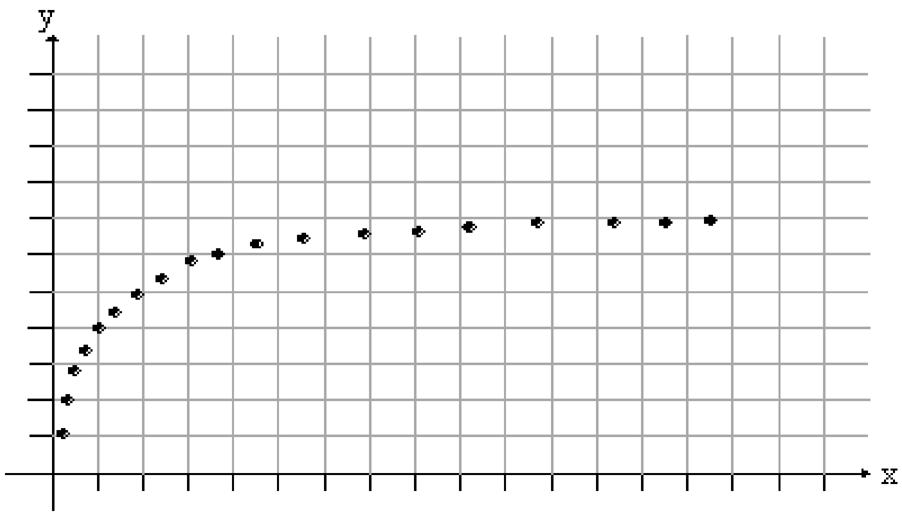
function	input	output
g	t^{th} hour	$\dfrac{\text{grams dye}}{\text{lb chemical}}$
p	t^{th} hour	20 lbs chemical
$20p$	t^{th} hour	lbs chemical

$$\therefore \quad g(t)[20p(t)]$$

$$\left(\frac{\text{grams dye}}{\text{lb } \cancel{\text{chemical}}}\right)\left(\frac{\text{lb } \cancel{\text{chemical}}}{1}\right)$$

What model should we consider using for the given scatter plot? Circle one.

a. logistic
b. cubic
c. linear
d. quadratic
e. logarithmic



The amount \$24503.57 is invested at 8.42% APR compounded weekly (there are 52 weeks in a year). What is the APY to two decimal places for this investment?

$$A(t) = P\left(1+\frac{r}{n}\right)^{nt}$$

$$A(1) = 24503.57\left(1+\frac{0.0842}{52}\right)^{(52)(1)} = \$26654.31$$

$$APY = \frac{26654.31 - 24503.57}{24503.57}\,100\% \approx 8.78\%$$

or $$A(t) = 24503.57\left(1+\frac{0.0842}{52}\right)^{52t}$$

$$= \underbrace{24503.57}_{a}\underbrace{\left[\left(1+\frac{0.0842}{52}\right)^{52}\right]}_{b}^{\overset{t}{x}}$$

$$f(x) = a\,b^{x}$$

percentage change

$$(b-1)100\% = \left[\left(1+\frac{0.0842}{52}\right)^{52} - 1\right]100\% \approx 8.78\% \text{ APY}$$

For the next two problems: A retro virus has attacked 310 people in a city. The table shows the number of infected people with respect to time t days.

t days	0	4	8	12	16	20	26	32	38	40	L_1
n(t) infected	310	455	598	808	1076	1250	1382	1452	1484	1492	L_2

Find the best model for the data.

Logistic L_1, L_2, Y_1

$$n(t) = \frac{1520.22827}{1 + 4.45327778\, e^{-0.1443201213t}}$$ is the number of city people infected with the retro virus after t days for $0 \le t \le 40$.

Which of the following limits would be best to use to estimate the total number of people that will be infected by the virus. Circle one.

a. $\lim_{t\to\infty} n(t) = 4.45$

b. $\lim_{t\to\infty} n(t) = 1520$

c. none of these

d. $\lim_{t\to\infty} n(t) = 760$

e. $\lim_{t\to\infty} n(t) = 10$

See numerator of logistic model; this is the limiting value.

If f(x) = $x^2 - 2x + 5$, use the derivative formula (no shortcuts) to calculate f '(x).

$(x, x^2 - 2x + 5)$

$(x+h, x^2 + 2hx + h^2 - 2x - 2h + 5)$

$f(x+h) = (x+h)^2 - 2(x+h) + 5$

$= x^2 + 2hx + h^2 - 2x - 2h + 5$

slope of secant: $\dfrac{f(x+h) - f(x)}{(x+h) - x} = \dfrac{(\cancel{x^2} + 2hx + h^2 - \cancel{2x} - 2h + \cancel{5}) - (\cancel{x^2} - \cancel{2x} + \cancel{5})}{(\cancel{x} + h) - \cancel{x}} = \dfrac{\cancel{h}(2x + h - 2)}{\cancel{h}} =$

$2x + h - 2$

slope of tangent

$f'(x) = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{(x+h) - x} = \lim_{h \to 0} (2x + h - 2) = 2x + 0 - 2 = 2x - 2$

$\therefore f'(x) = 2x - 2$

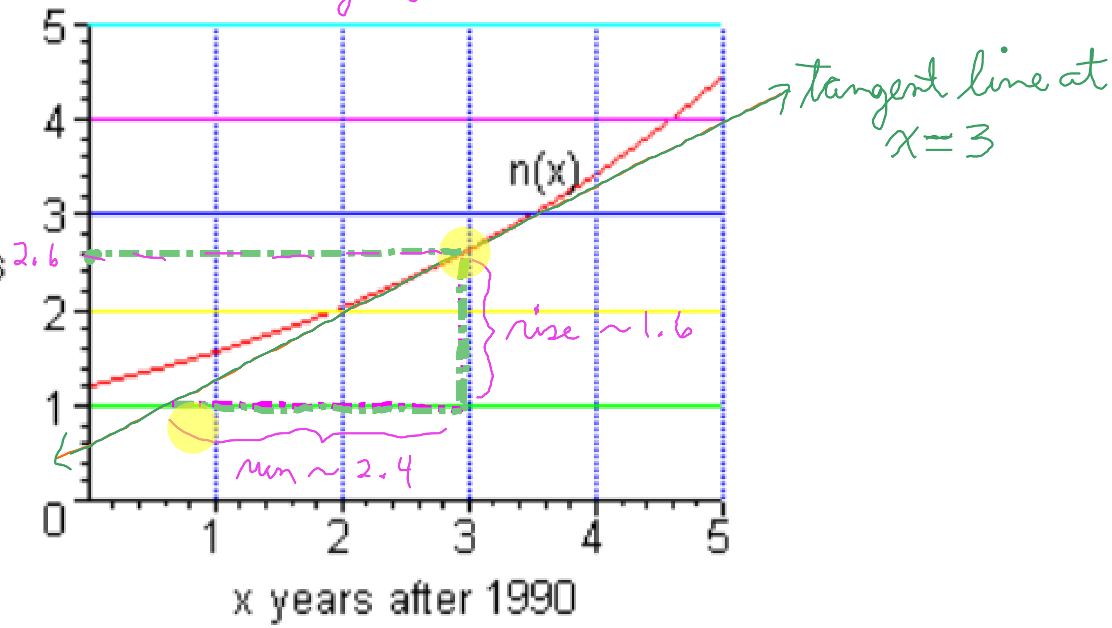
The graph of thousands of kangaroos n(x) in zoos for x years after 1990 for $0 \le x \le 5$ is shown. Use the graph to estimate the percentage rate of change, to 2 decimal places, at $x = 3$.

percentage rate of change = $\dfrac{\text{rate of change at point}}{\text{value of function at point}}$ 100%

$\approx \dfrac{\dfrac{1.6 \text{ thous kang}}{2.4 \text{ years}}}{2.6 \text{ thousand kang}} 100\% \approx \dfrac{25.64\%}{\text{year}}$

n(x) thousands of kangaroos

In 1993 the percentage rate of change is about 25.64 % per year.



The table gives the height above sea level of a guided missile after being fired off a battleship.

t seconds after launch	0	0.5	1.2	2.4	3.6	4.2	L_1
m meters above sea level	46	98	120	110	54	18	L_2

a. Using the data, what is the percent change, to two decimals, in height of the missile from 2.4 to 3.6 seconds?

$$\frac{54-110}{110}\,100\% = -50.9090909\overline{1}\ \%$$

from 2.4 to 3.6 seconds the height of the missile is decreasing about 50.91 %.

b. Using the data, what is the average rate of change, to two decimals, in height of the missile from 2.4 to 3.6 seconds?

$$\frac{54-110}{3.6-2.4} = -46.6666667$$

from 2.4 to 3.6 seconds the average rate of change of the missile's height is decreasing about 46.67 meters per second.

c. Use the appropriate model to estimate the height of the missile above sea level 4.0 seconds after launching. (note no inflection point)

QuadReg L1, L2, Y1

The missile's height above sea level is

$m(t) = -19.7299946t^2 + 72.33211047t + 55.99569668$ meters,

t seconds after launch for $0 \le t \le 4.2$.

$Y_1(4) = 29.64422489$

At 4.0 seconds the missile is about 30 meters above sea level.

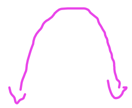
d. Use the model to estimate to one decimal place, when the missile will hit the water.

$Y_2 = 0$ and intersect or trace or zero

The missile will hit the water about 4.3 seconds after launch.

e. Discuss concavity of the graph of the model.

It is concave down.



The amount \$38685.00 is invested at 7.9% APR compounded monthly. What is the APY to two decimal places for this investment?

$$A(t) = P\left(1+\frac{r}{n}\right)^{nt}$$

$$A(1) = 38685.00\left(1+\frac{0.079}{12}\right)^{(12)(1)} = \$41854.24$$

$$APY = \frac{41854.24 - 38685.00}{38685.00} 100\% \approx 8.19\%.$$

If f(x) = $x^2 - 3x + 6$, use the derivative formula (no shortcuts) to calculate $f'(x)$.

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

$$= \lim_{h \to 0} \frac{\left[(x+h)^2 - 3(x+h) + 6\right] - \left[x^2 - 3x + 6\right]}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{x^2} + 2hx + h^2 - \cancel{3x} - 3h + \cancel{6} - \cancel{x^2} + \cancel{3x} - \cancel{6}}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(2x + h - 3)}{\cancel{h}}$$

$$= \lim_{h \to 0} (2x + h - 3)$$

$$= 2x + 0 - 3$$

$$= 2x - 3$$

Show your work when calculating the following.

$$\lim_{x\to -7}\frac{x^2-49}{x+7} = \lim_{x\to -7}\frac{\cancel{(x+7)}(x-7)}{\cancel{x+7}} = \lim_{x\to -7}(x-7) = -7-7 = -14$$