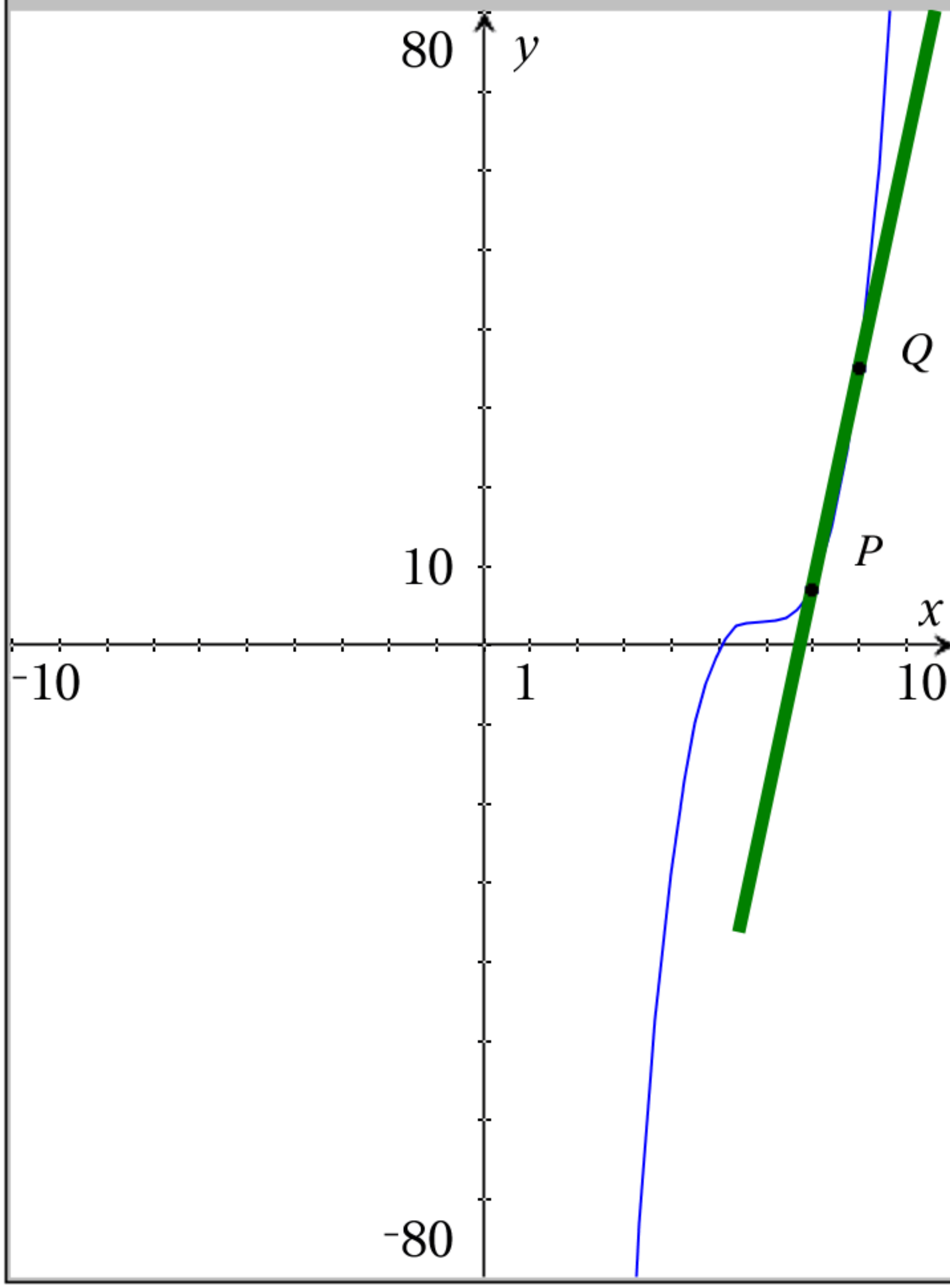


$f(x)=4(x-6)^3+3$

P = (7,7)

Q = (8,35)

Slope of PQ =28

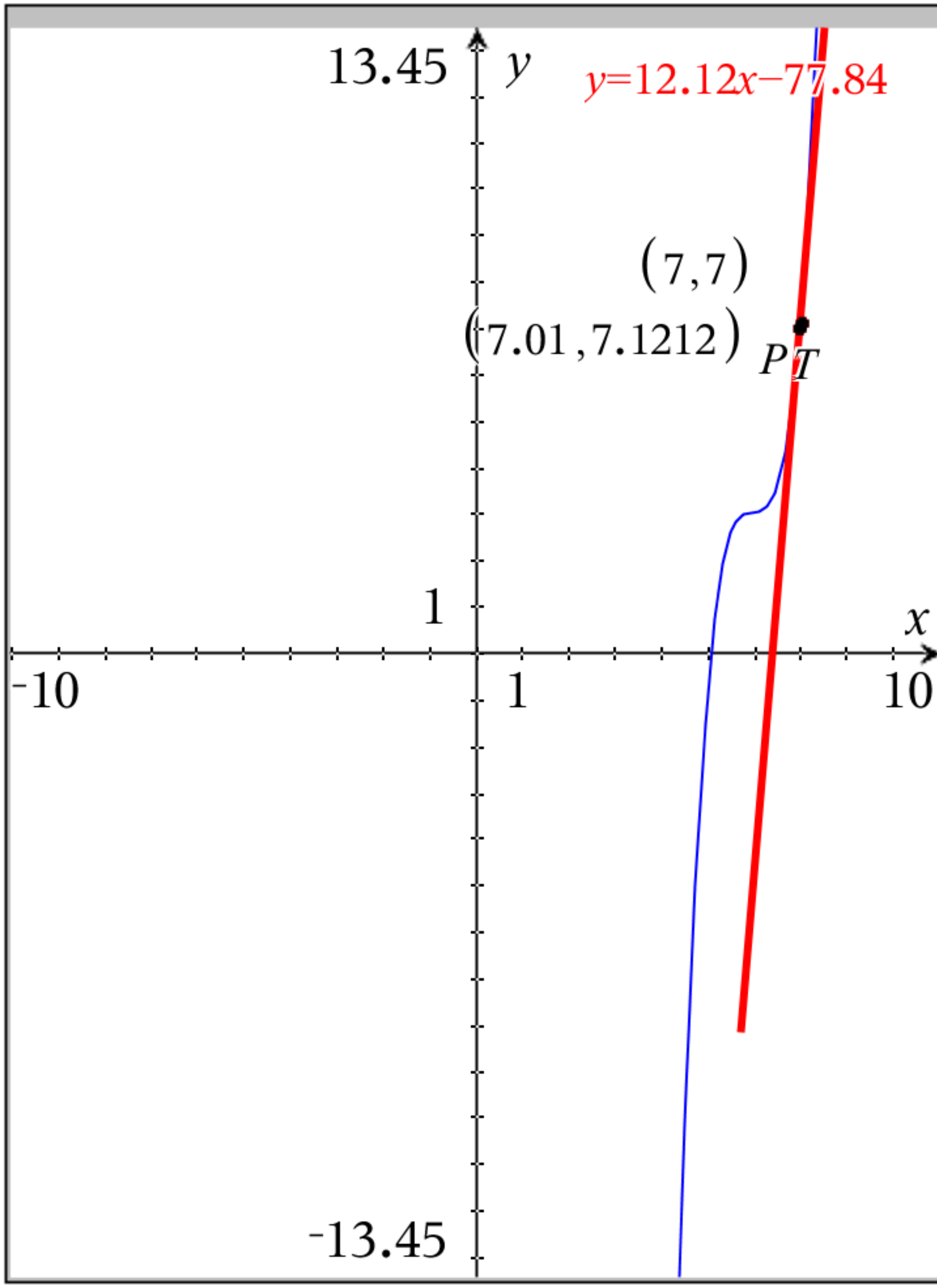
Secant line

Point Slope Form

$y = 28(x-7)+7$

Slope Intercept Form

$y=28\cdot x-189$



f(x)$=4(x-6)^3+3$

P = (7,7)

T = (7.01,7.121204)

Slope of PT =12.1204

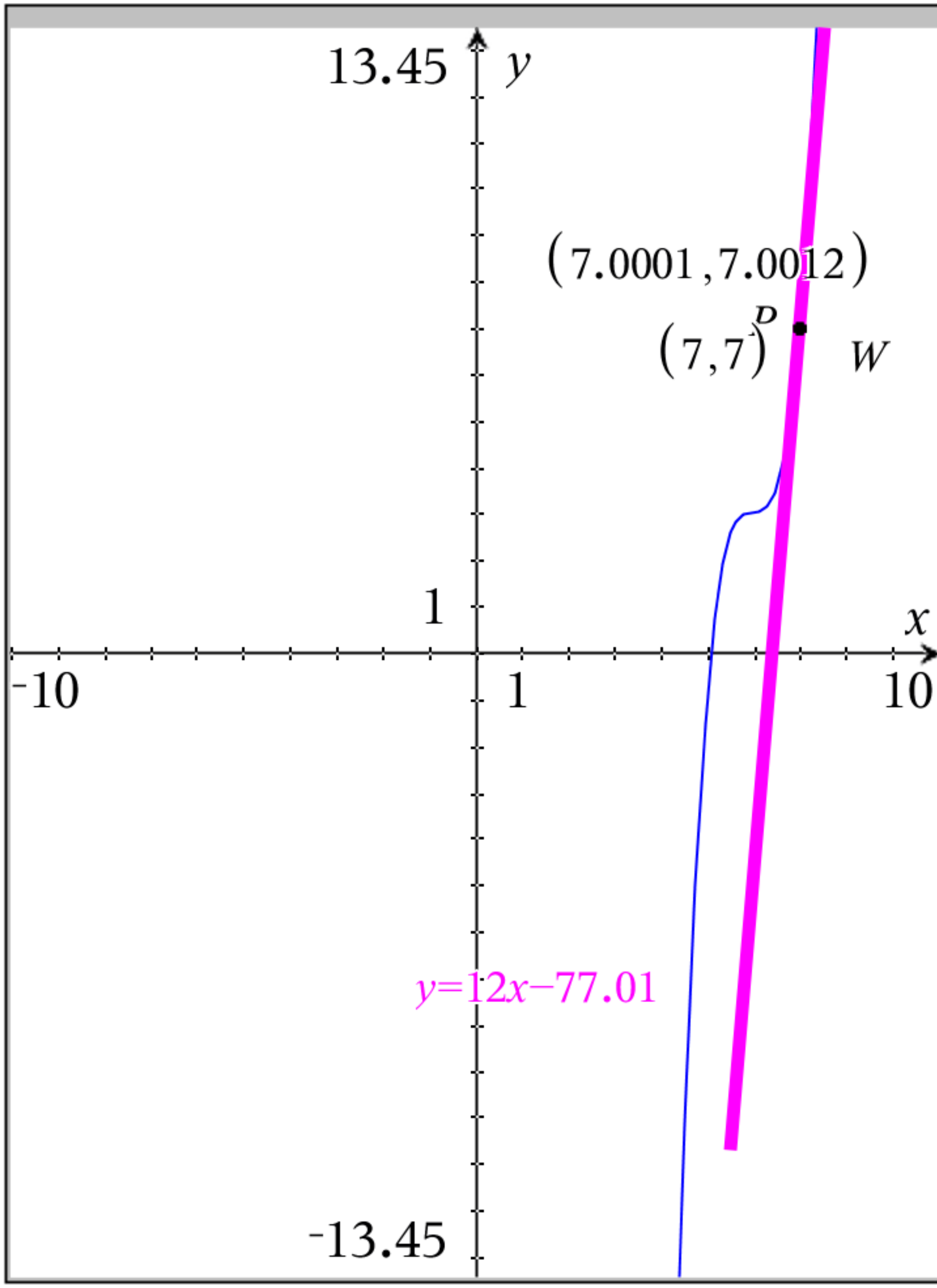
Secant line

Point Slope Form

y = 12.1204(x−7)+7

Slope Intercept Form

y =$12.1204\cdot x-77.8428$



$f(x)=4(x-6)^3+3$

P = (7,7)

W = (7.0001,7.00120012)

Slope of PW =12.00120004

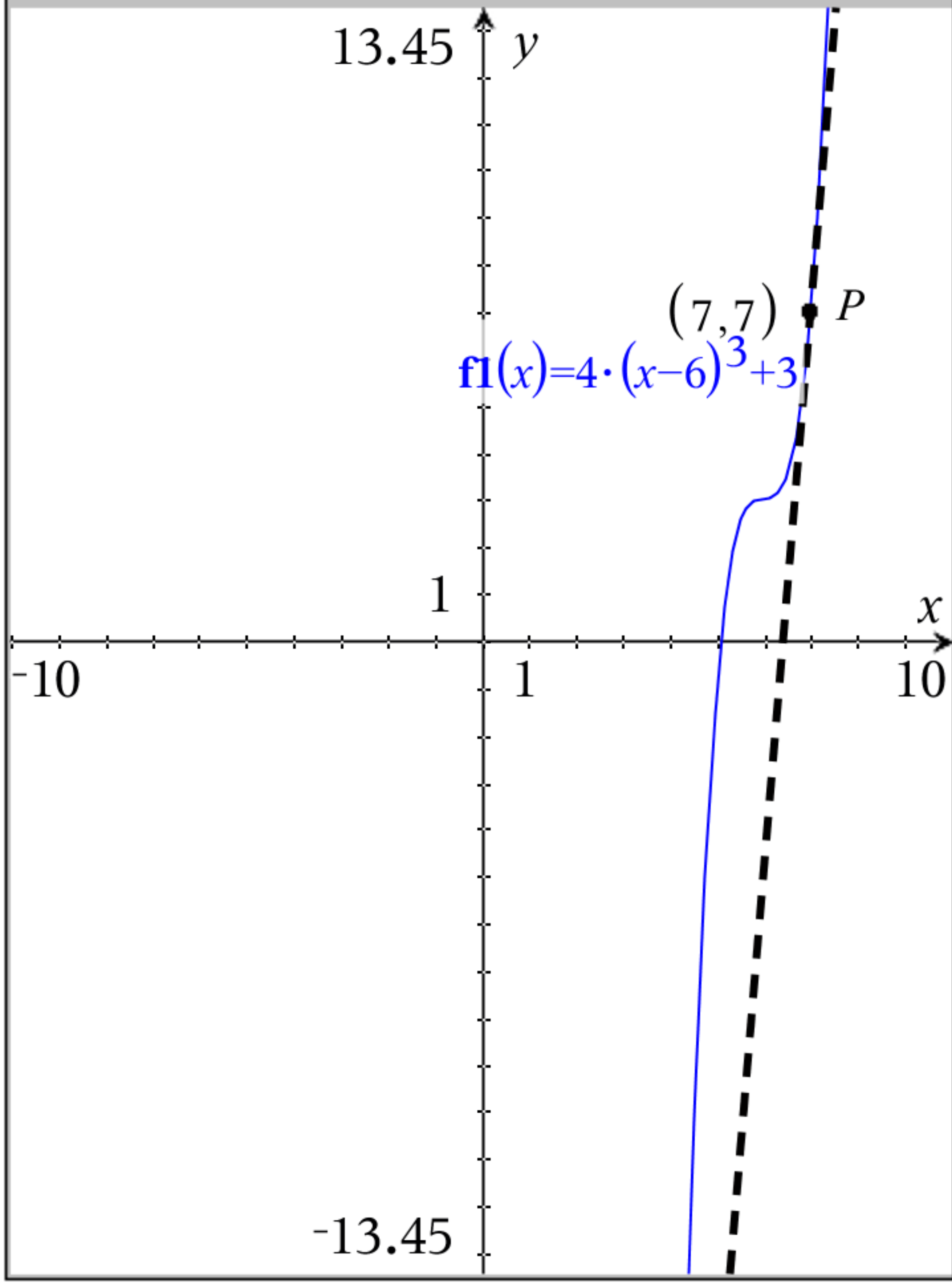
Secant line

Point Slope Form

$y = 12.00120004(x-7)+7$

Slope Intercept Form

$y = 12.00120004 \cdot x - 77.00840028$



$f(x)=4(x-6)^3+3$

P = (7,7)

ACTUAL Tangent Line

Point Slope Form

$y = 12(x-7)+7$

Slope Intercept Form

$y = 12 \cdot x - 77$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 7$,

In my simple examples Q's x value was $x = 8$,

and it led to a slope of secant line through P and Q of $m = 28$

In my simple examples T's x value was $x = 7.01$,

and it led to a slope of secant line through P and T of $m = 12.1204$

In my simple examples W's x value was $x = 7.0001$,

and it led to a slope of secant line through P and W of $m = 12.00120004$

Say I took the time to find slope between P and one last value of C at $x = 7.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 12.$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = 12$ which is the the slope of the tangent line at $x = 7$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

$f(x) = 4\cdot x^{3}-72\cdot x^{2}+432\cdot x-861$

P has x value 7 P has y value $f(7)=7$ P $(7,7)$

Q has x value 8 Q has y value $f(8)=35$ Q $(8,35)$

m of PQ = 28

T has x value 7.01 T has y value $f(7.01)=7.121204$ T $(7.01,7.121204)$

m of PT = 12.1204

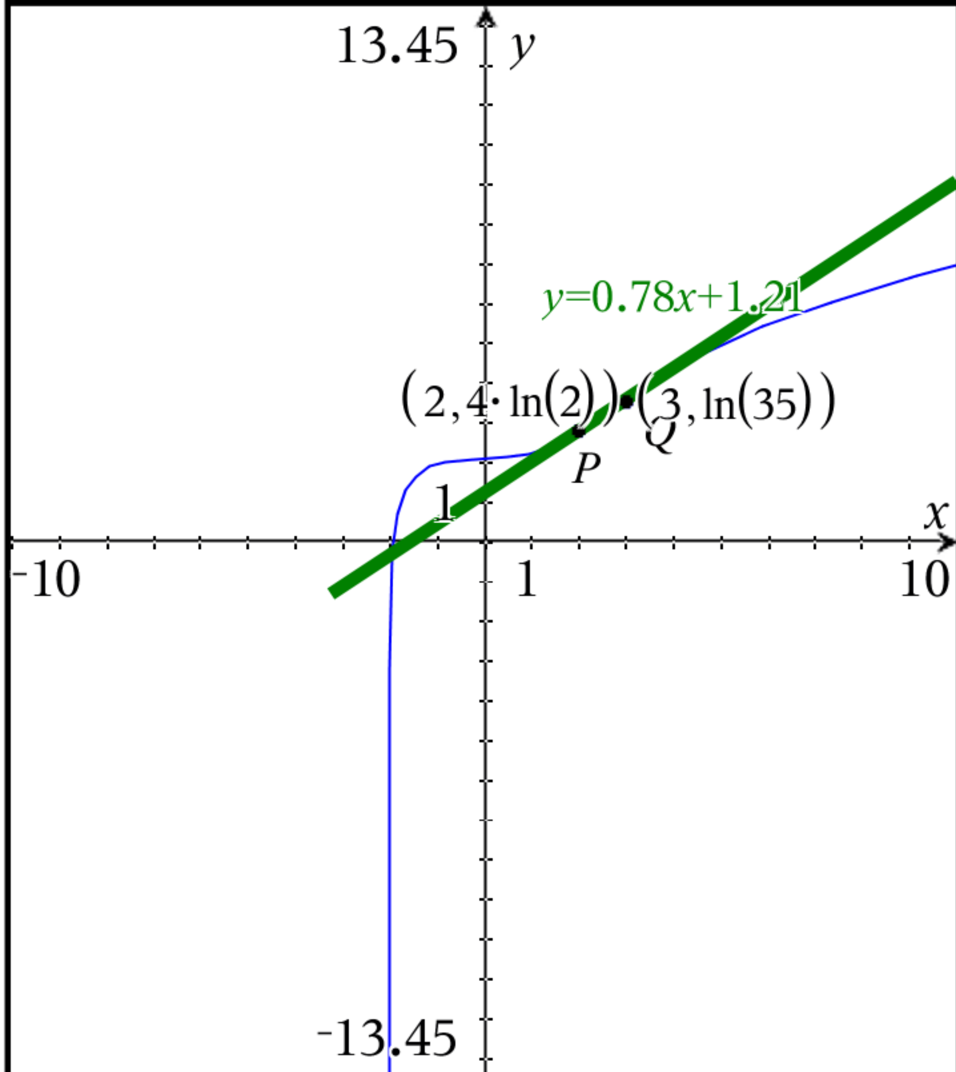
W has x value 7.0001 W has y value $f(7.0001)=7.00120012$ W $(7.0001,7.00120012)$

m of PW = 12.00120004

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 7 m tan = 12 SO as x $\rightarrow 7$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow 12$

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	7	7	x_p	y_p	x_p	y_p
2	Q	8	35	x_q	y_q	x_t	y_t
3	m_pq	28	28.				
4	change_y	28					
5	change_x	1					
6	T	7.01	7.121204				
7	change_y	0.121204					
8	change_x	0.01					
9	m_pt	12.1204					
10	W	7.0001	7.00120...				
11	change_y	0.001200120004					

A1 "P"



$g(x)=\ln(8+x^3)$

P = $\left(2,4\cdot \ln(2)\right) \approx (2.,2.77258872224)$

Q = $\left(3,\ln(35)\right) \approx (3.,3.55534806149)$

Slope of PQ $=\ln\left(\frac{35}{16}\right)$

≈ 0.78275933925

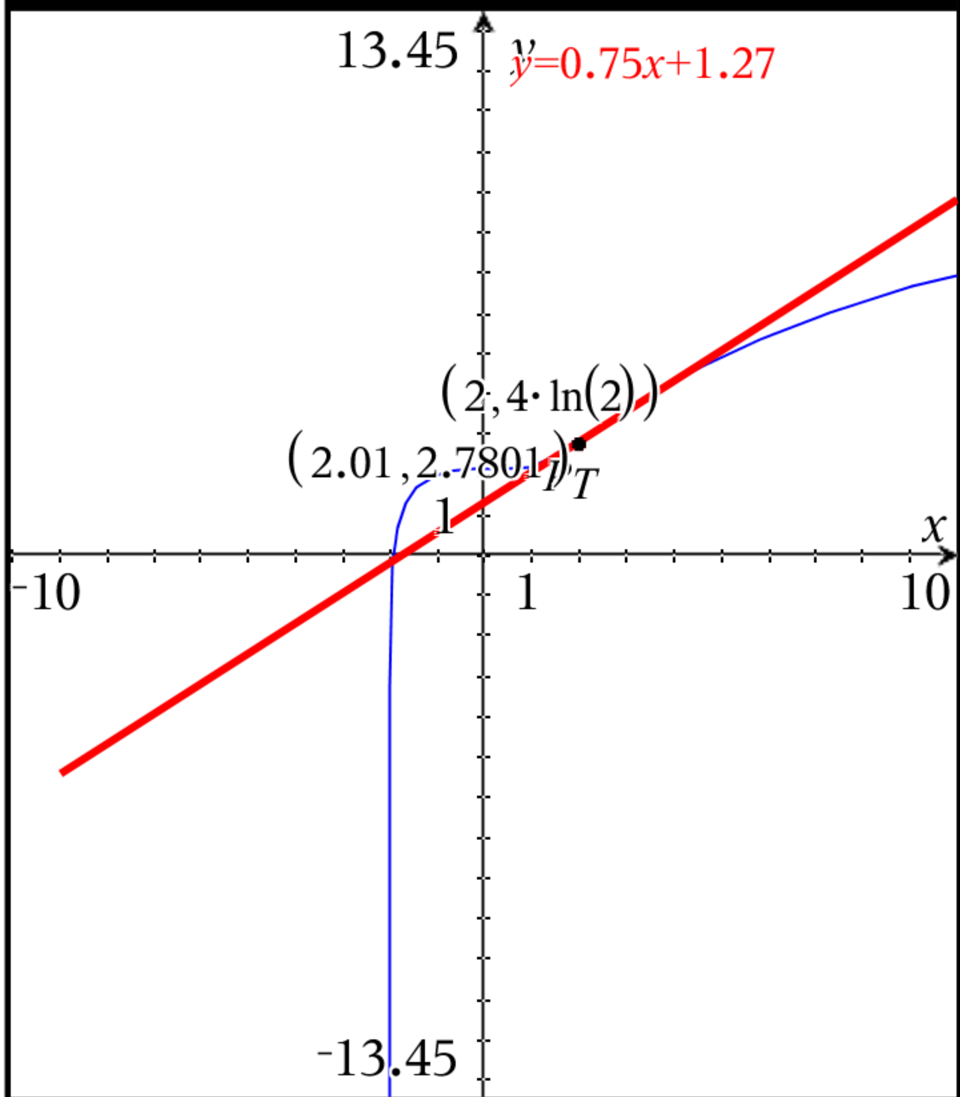
Secant line

Point Slope Form

$y = \ln\left(\frac{35}{16}\right)(x-2)+4\cdot \ln(2)$

Slope Intercept Form

$y\approx 0.78275933925\cdot x$
$+1.20707004374$



$g(x)=\ln\left(8+x^3\right)$

P = $(2,4\cdot\ln(2))$

T = $(2.01,2.78009801926)$

Slope of PT $=0.75092970221$

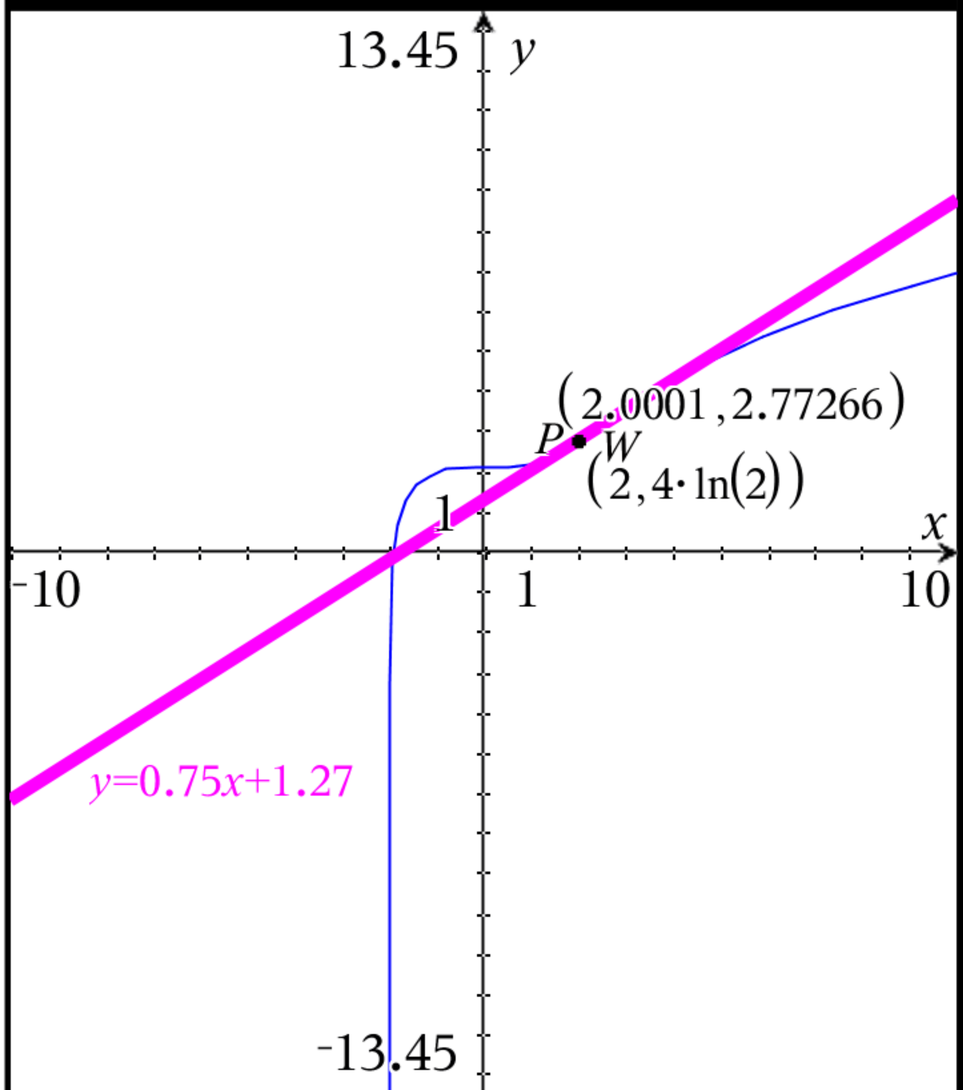
Secant line

Point Slope Form

$y = 0.75092970221(x-2)+4\cdot\ln(2)$

Slope Intercept Form

$y = 0.75092970221\cdot x+1.27072931782$



$g(x)=\ln\left(8+x^3\right)$

P = $\left(2,4\cdot \ln(2)\right)$

W = $(2.0001, 2.77266372318)$

Slope of PW $= 0.750009374$

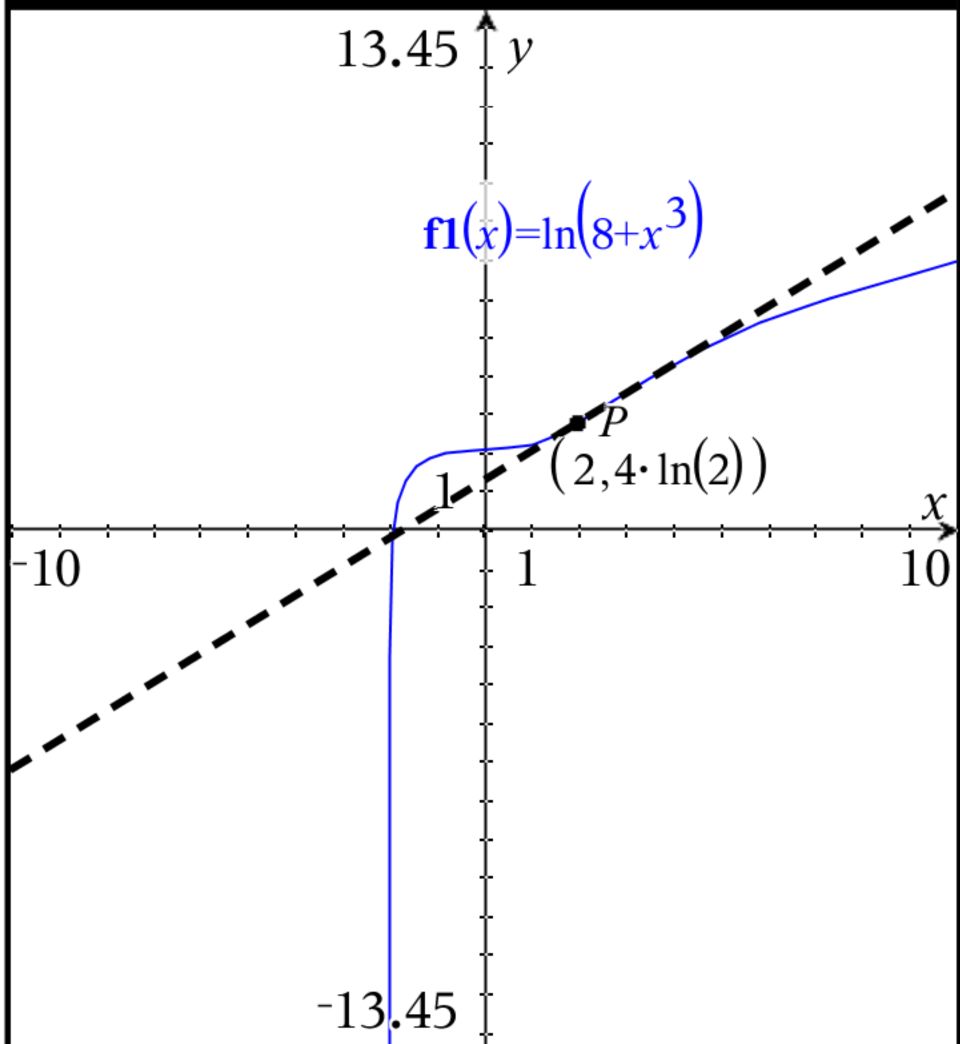
Secant line

Point Slope Form

$y = 0.750009374(x-2)+4\cdot \ln(2)$

Slope Intercept Form

$y = 0.750009374\cdot x + 1.27256997424$



$P = (2, 4\cdot \ln(2))$

ACTUAL Tangent Line

Point Slope Form

$$y = \frac{3}{4}(x-2)+4\cdot \ln(2)$$

Slope Intercept Form

$$y = \frac{3\cdot x}{4}+4\cdot \ln(2)-\frac{3}{2}$$

$g(x)=\ln\left(8+x^3\right)$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 2$,

In my simple examples Q's x value was $x = 3$,

and it led to a slope of secant line through P and Q of $m = \ln\left(\frac{35}{16}\right) = 0.78275933925$

In my simple examples T's x value was $x = 2.01$,

and it led to a slope of secant line through P and T of $m = 0.75092970221$

In my simple examples W's x value was $x = 2.0001$,

and it led to a slope of secant line through P and W of $m = 0.750009374$

Say I took the time to find slope between P and one last value of C at $x = 2.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 0.75$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = \frac{3}{4}$

which is the the slope of the tangent line at $x = 2$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1 - y2}{x1 - x2} = \frac{y2 - y1}{x2 - x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

g(x) = $\ln\left(x^3+8\right)$

P has x value 2 P has y value g(2)=$4\cdot\ln(2)$ P $(2,4\cdot\ln(2))$ ≈P $(2.,2.77258872224)$

Q has x value 3 Q has y value g(3)=$\ln(35)$ Q $(3,\ln(35))$ ≈ Q $(3.,3.55534806149)$

m of PQ = $\ln\left(\frac{35}{16}\right)\approx 0.78275933925$

T has x value 2.01 T has y value g(2.01)=2.78009801926 T $(2.01,2.78009801926)$

m of PT = 0.75092970221

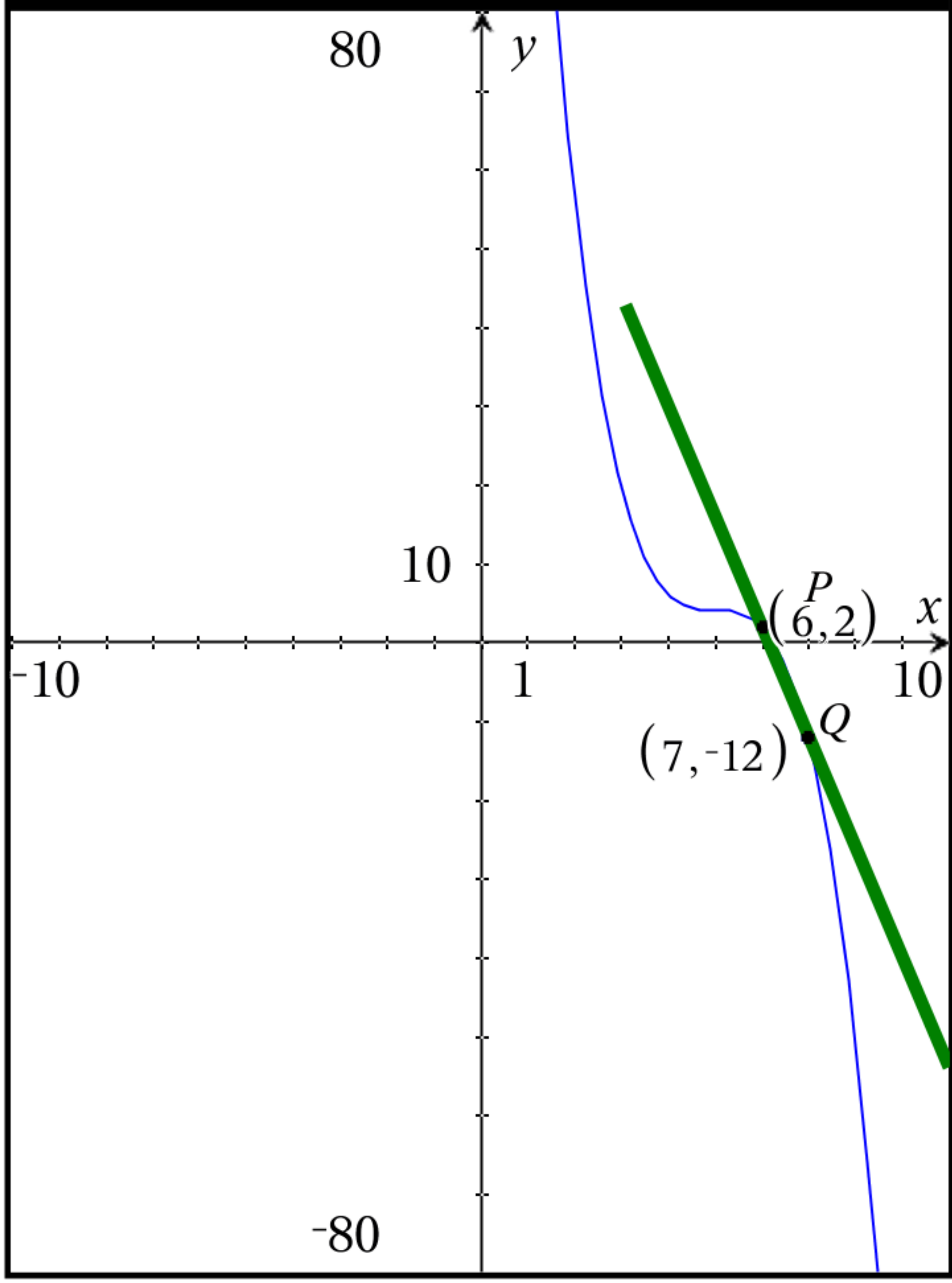
W has x value 2.0001 W has y value g(2.0001)=2.77266372318 W $(2.0001,2.77266372318)$

m of PW = 0.750009374

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 2 m tan = $\frac{3}{4}$ SO as x $\rightarrow 2$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow \frac{3}{4}$

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	**2**	**4*ln(2)**	x_p	y_p	x_p	y_p
2	Q	**3**	**ln(35)**	x_q	y_q	x_t	y_t
3	m_pq	**ln(35/16)**	0.78275...				
4	change_y	**ln(35/16)**					
5	change_x	**1**					
6	T	**2.01**	**2.78009...**				
7	change_y	**0.007509297022**					
8	change_x	**0.01**					
9	m_pt	**0.75092970221**					
10	W	**2.0001**	**2.77266...**				
11	change_y	**0.000075000937**					

A1 "P"



$f(x) = -2(x-5)^3+4$

P = (6,2)

Q = (7,-12)

Slope of PQ = -14

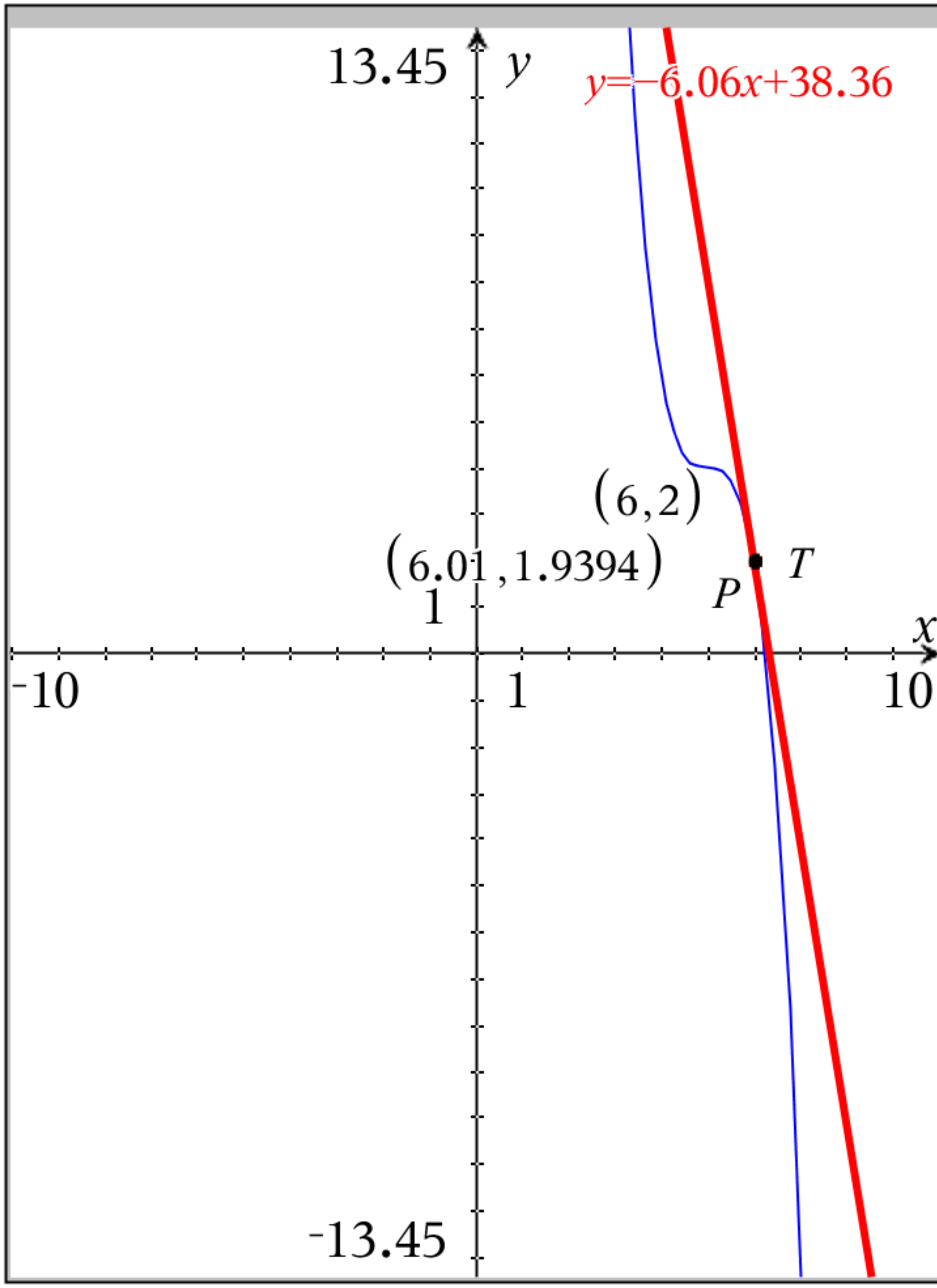
Secant line

Point Slope Form

$y = -14(x-6)+2$

Slope Intercept Form

$y=86-14\cdot x$



$f(x) = -2(x-5)^3+4$

P = (6,2)

T = (6.01 ,1.939398)

Slope of PT = ⁻6.0602

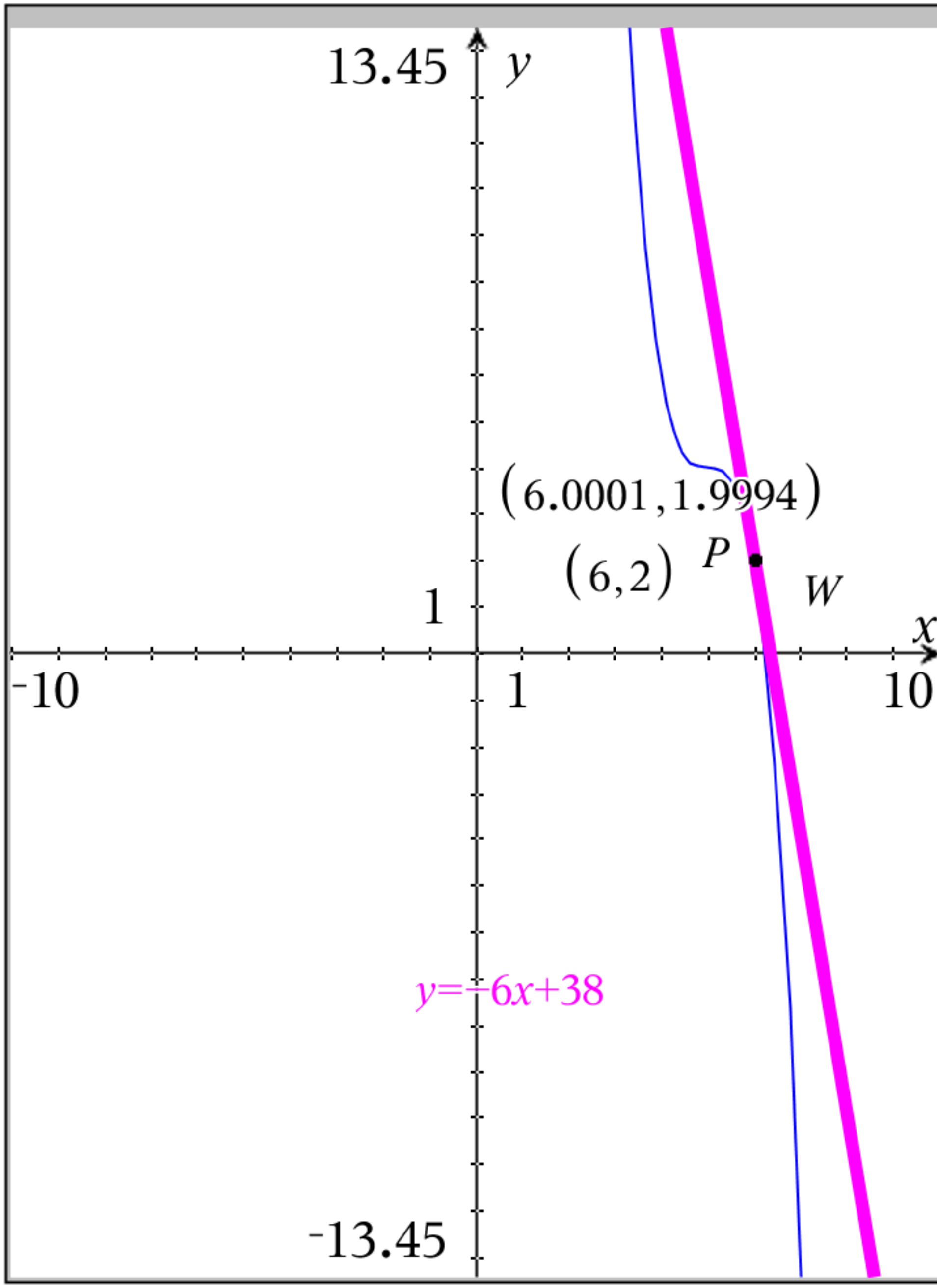
Secant line

Point Slope Form

$y = ^{-}6.0602\,(x-6)+2$

Slope Intercept Form

$y = 38.3612-6.0602\cdot x$



$f(x) = -2(x-5)^3+4$

P = (6,2)

W = (6.0001 ,1.99939994)

Slope of PW = -6.00060002

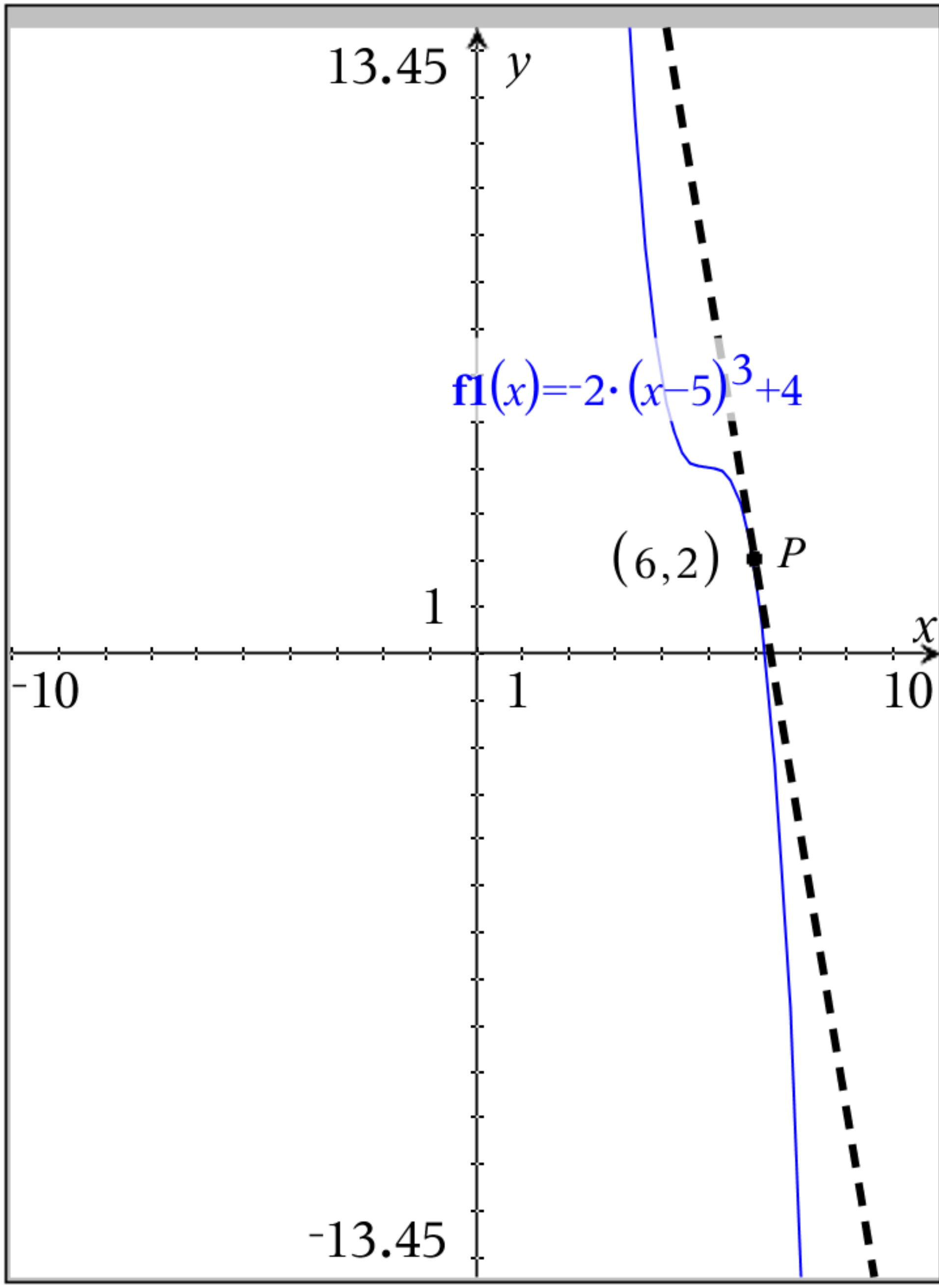
Secant line

Point Slope Form

y = -6.00060002 (x-6)+2

Slope Intercept Form

y = 38.00360012-6.00060002 · x



$f(x) = -2(x-5)^3+4$

$P = (6,2)$

ACTUAL Tangent Line

Point Slope Form

$y = {}^{-}6(x-6)+2$

Slope Intercept Form

$y = 38-6\cdot x$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 6$,

In my simple examples Q's x value was $x = 7$,

and it led to a slope of secant line through P and Q of $m = {}^{-}14$

In my simple examples T's x value was $x = 6.01$,

and it led to a slope of secant line through P and T of $m = {}^{-}6.0602$

In my simple examples W's x value was $x = 6.0001$,

and it led to a slope of secant line through P and W of $m = {}^{-}6.00060002$

Say I took the time to find slope between P and one last value of C at $x = 6.00000001$

and it led to a slope of secant line through P and that point C of $m \approx {}^{-}6.$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of m $= {}^{-}6$ which is the the slope of the tangent line at $x = 6$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

$f(x) = {}^{-}2\cdot x^3+30\cdot x^2-150\cdot x+254$

P has x value 6 P has y value f(6)=2 P(6,2)

Q has x value 7 Q has y value f(7)=⁻12 Q(7,⁻12)

m of PQ = ⁻14

T has x value 6.01 T has y value f(6.01)=1.939398 T(6.01,1.939398)

m of PT = ⁻6.0602

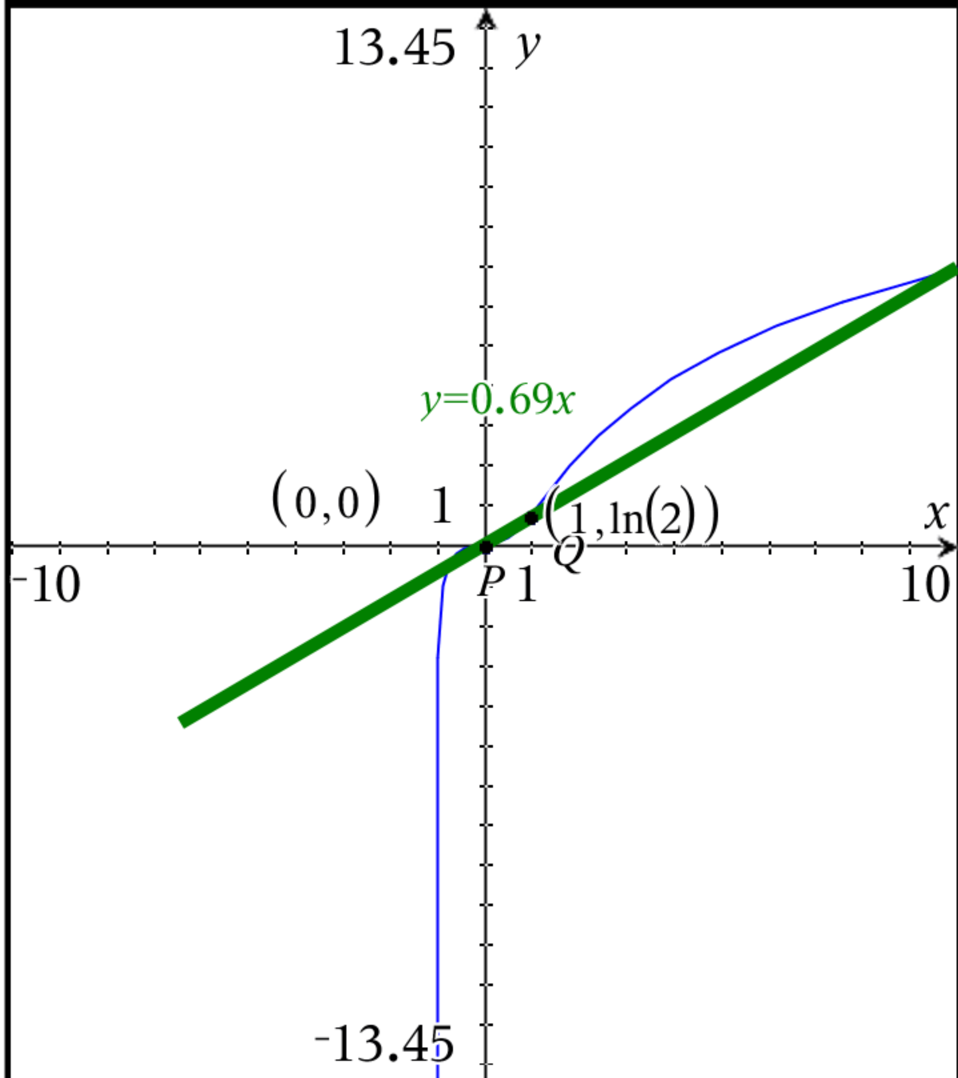
W has x value 6.0001 W has y value f(6.0001)=1.99939994 W(6.0001,1.99939994)

m of PW = ⁻6.00060002

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 6 m tan = ⁻6 SO as x →6 we can say that the slope of the tangent line and the instantaneous rate of change→⁻6

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	6	2	x_p	y_p	x_p	y_p
2	Q	7	-12	x_q	y_q	x_t	y_t
3	m_pq	-14	-14.				
4	change_y	-14					
5	change_x	1					
6	T	6.01	1.939398				
7	change_y	-0.060602					
8	change_x	0.01					
9	m_pt	-6.0602					
10	W	6.0001	1.99939...				
11	change_y	-0.000600060002					

B2 x_q:=b1+1



$g(x)=\ln\left(1+x^3\right)$

P $= (0,0) \approx (0.,0.)$

Q $= (1,\ln(2)) \approx (1.,0.69314718056)$

Slope of PQ $=\ln(2)$

≈ 0.69314718056

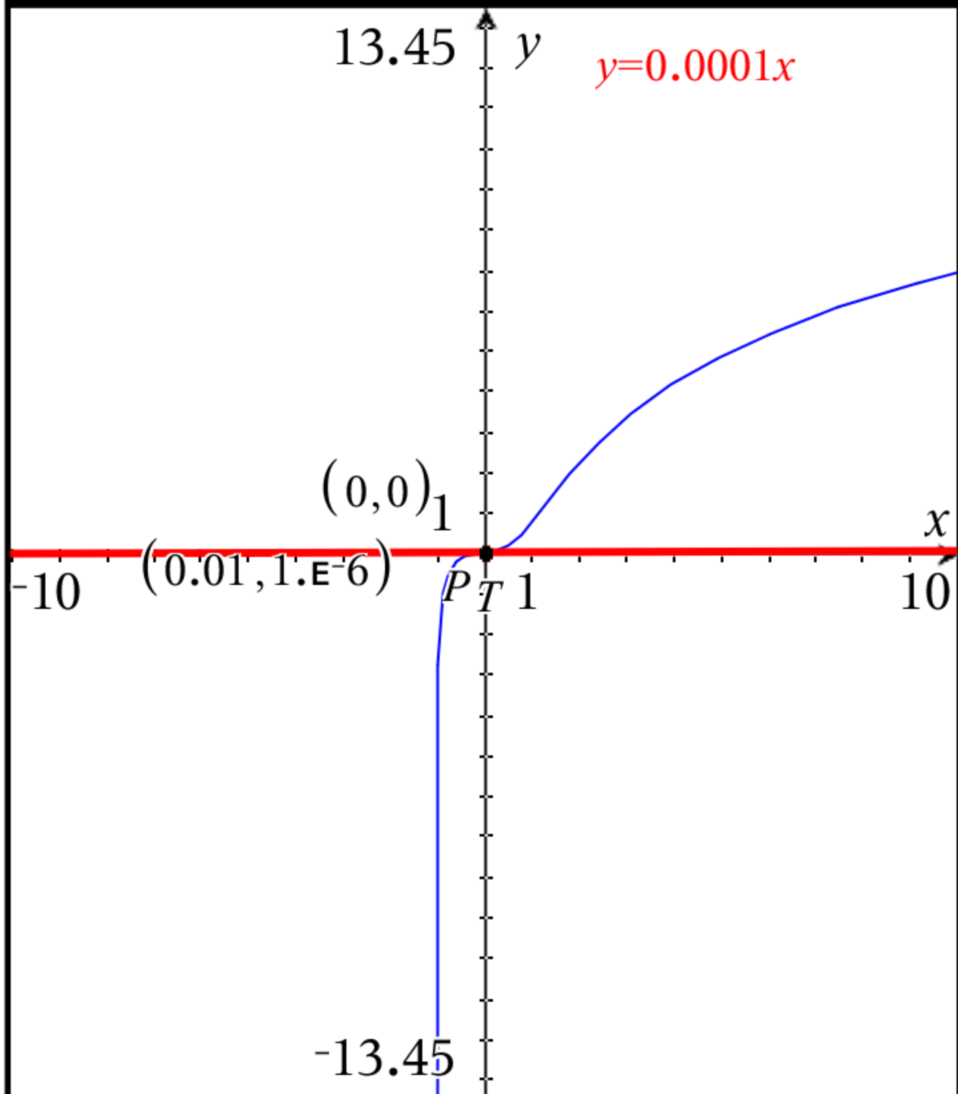
Secant line

Point Slope Form

$y = \ln(2)(x-0)+0$

Slope Intercept Form

$y\approx 0.69314718056\cdot x$



$g(x)=\ln\left(1+x^3\right)$

P = (0,0)

T = (0.01 ,0.000001)

Slope of PT =0.00009999995

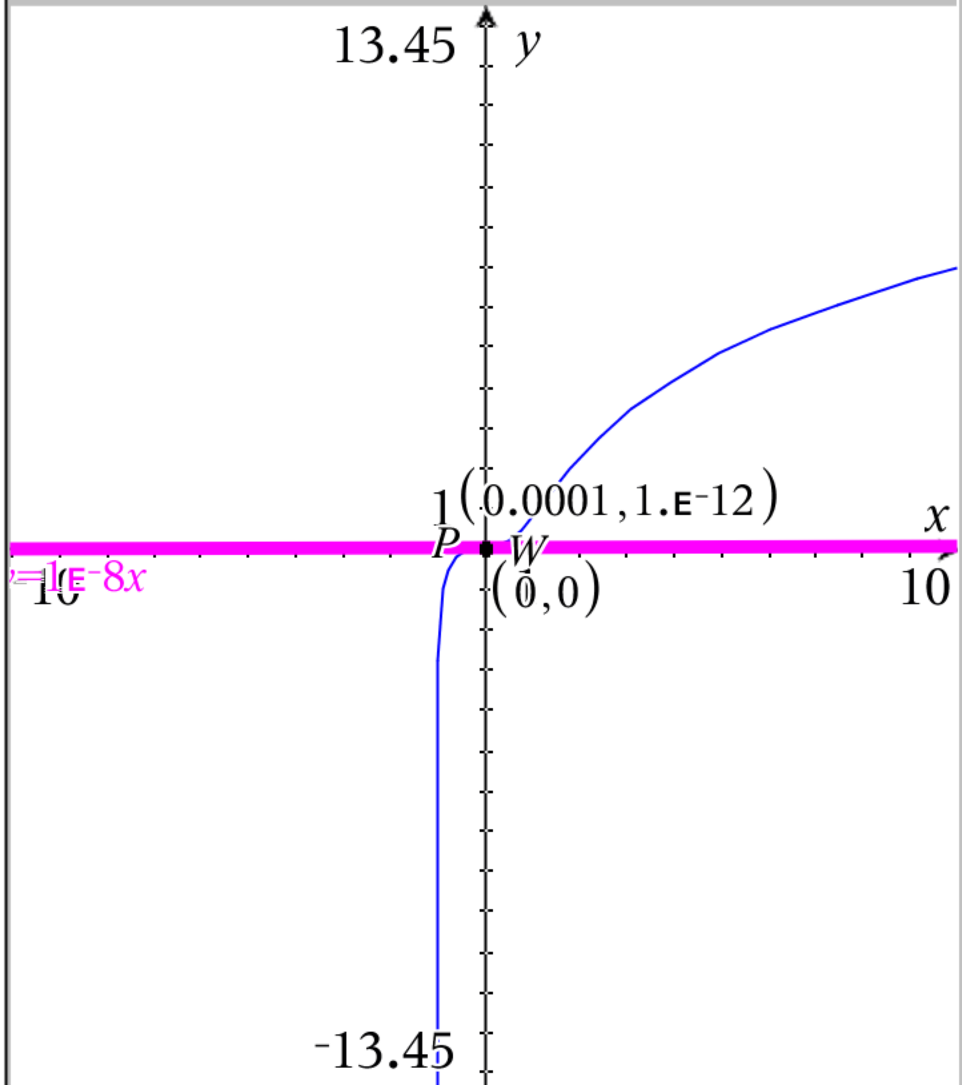
Secant line

Point Slope Form

y = 0.00009999995 (x−0)+0

Slope Intercept Form

y =0.00009999995$\cdot x$



$g(x)=\ln\left(1+x^3\right)$

P = (0,0)

W = (0.0001 ,1.E-12)

Slope of PW = 0.00000001

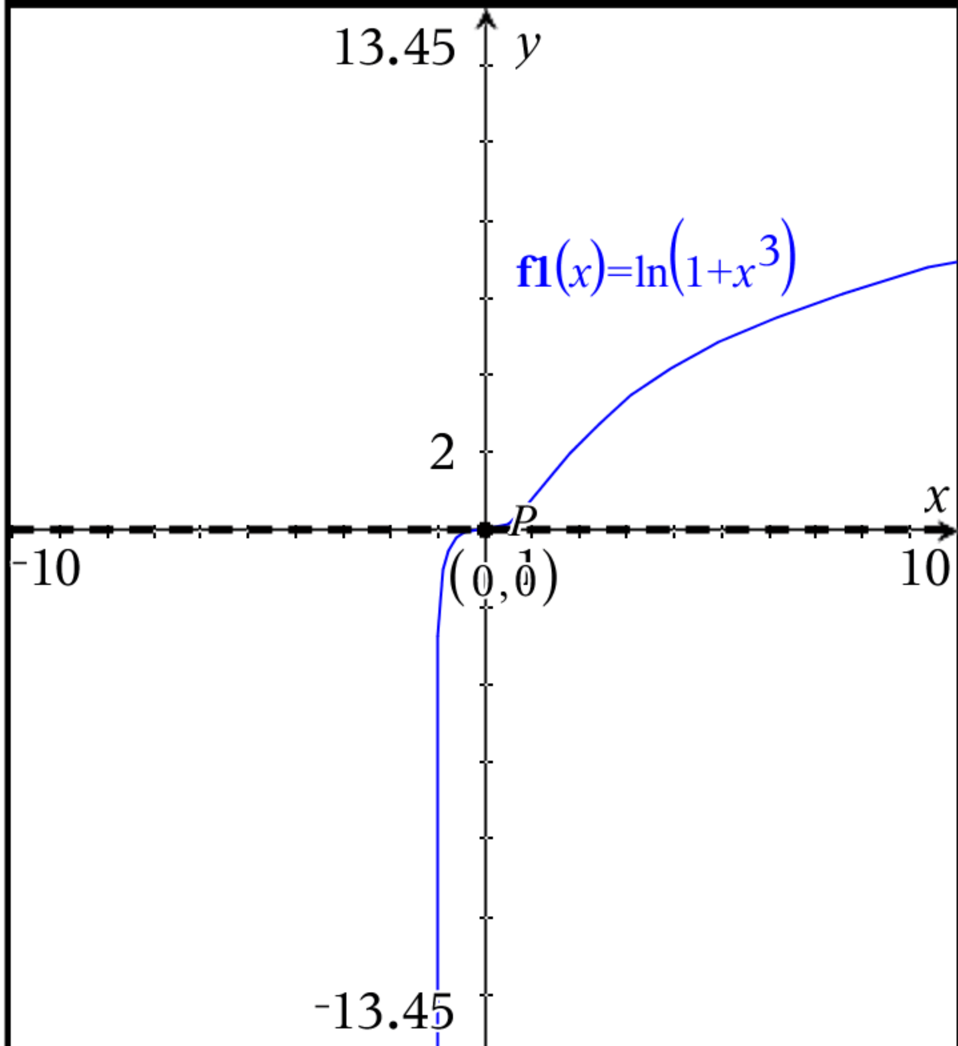
Secant line

Point Slope Form

y = 0.00000001 (x−0)+0

Slope Intercept Form

y = $0.00000001\cdot x$



$g(x)=\ln(1+x^3)$

P = (0,0)

ACTUAL Tangent Line

Point Slope Form

y = 0 (x−0)+0

Slope Intercept Form

y =0

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 0$,

In my simple examples Q's x value was $x = 1$,

and it led to a slope of secant line through P and Q of $m = \ln(2) = 0.69314718056$

In my simple examples T's x value was $x = 0.01$,

and it led to a slope of secant line through P and T of $m = 0.00009999995$

In my simple examples W's x value was $x = 0.0001$,

and it led to a slope of secant line through P and W of $m = 0.00000001$

Say I took the time to find slope between P and one last value of C at $x = 0.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 0.$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = 0$ which is the the slope of the tangent line at $x = 0$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

g(x) $=\ln\left(x^3+1\right)$

P has x value 0 P has y value $g(0)=0$ P $(0,0)\approx$ P $(0.,0.)$

Q has x value 1 Q has y value $g(1)=\ln(2)$ Q $(1,\ln(2))\approx$ Q $(1.,0.69314718056)$

m of PQ = $\ln(2)\approx 0.69314718056$

T has x value 0.01 T has y value $g(0.01)=0.000001$ T $(0.01,0.000001)$

m of PT = 0.00009999995

W hasx value0.0001 W hasy valueg$(0.0001)=1.\mathrm{E}{-12}$ W $(0.0001,1.\mathrm{E}{-12})$

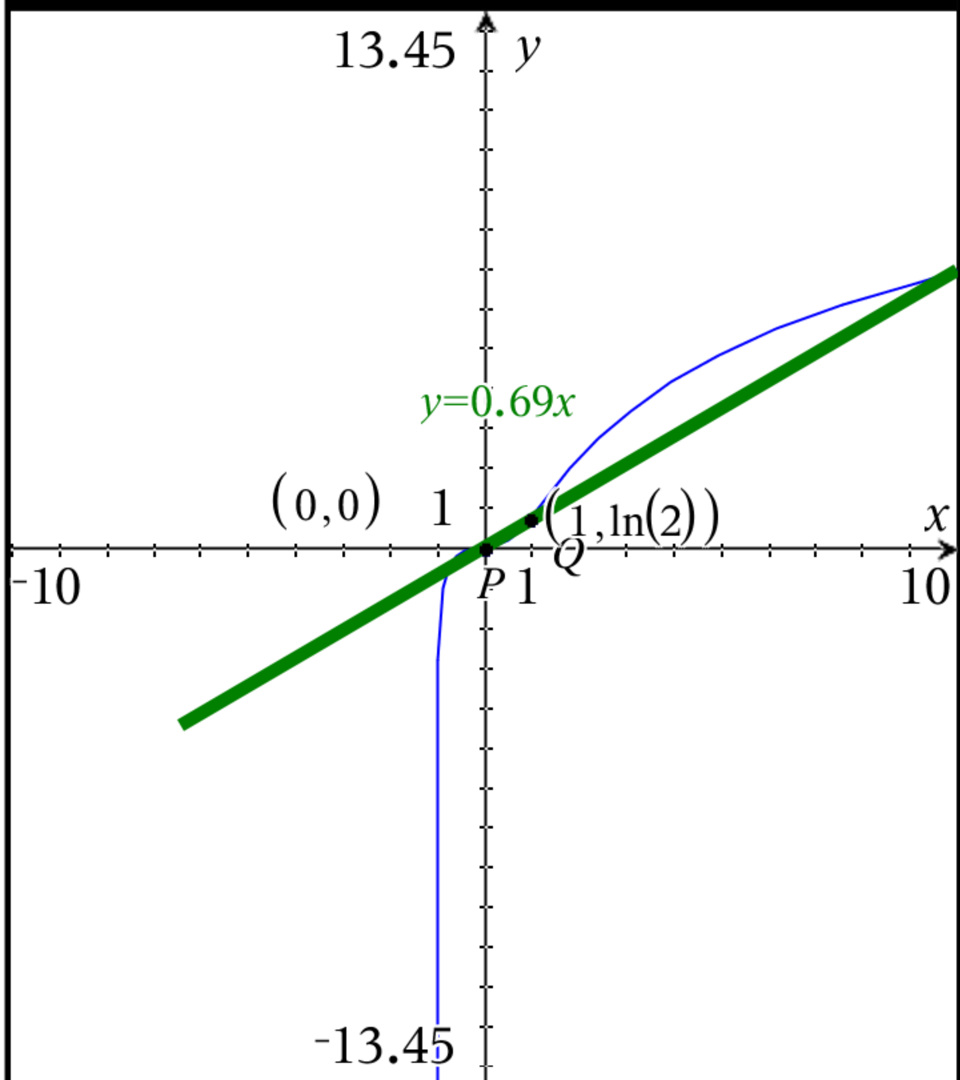
m of PW = 0.00000001

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 0 m tan = 0 SO as x $\rightarrow 0$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow 0$

	A	B	C	D x_1	E y_1	F x_2	G y_
=							
1	P	0	0	x_p	y_p	x_p	y_p
2	Q	1	ln(2)	x_q	y_q	x_t	y_t
3	m_pq	ln(2)	0.69314...				
4	change_y	ln(2)					
5	change_x	1					
6	T	0.01	0.000001				
7	change_y	0.000001					
8	change_x	0.01					
9	m_pt	0.00009999995					
10	W	0.0001	1.E-12				
11	change_y	1.E-12					

B2 $\mathbf{x\_q}:=b1+1$

Problem 1



$g(x)=\ln\left(1+x^3\right)$

$P = (0,0) \approx (0.,0.)$

$Q = (1,\ln(2)) \approx (1.,0.69314718056)$

Slope of PQ $=\ln(2)$

≈ 0.69314718056

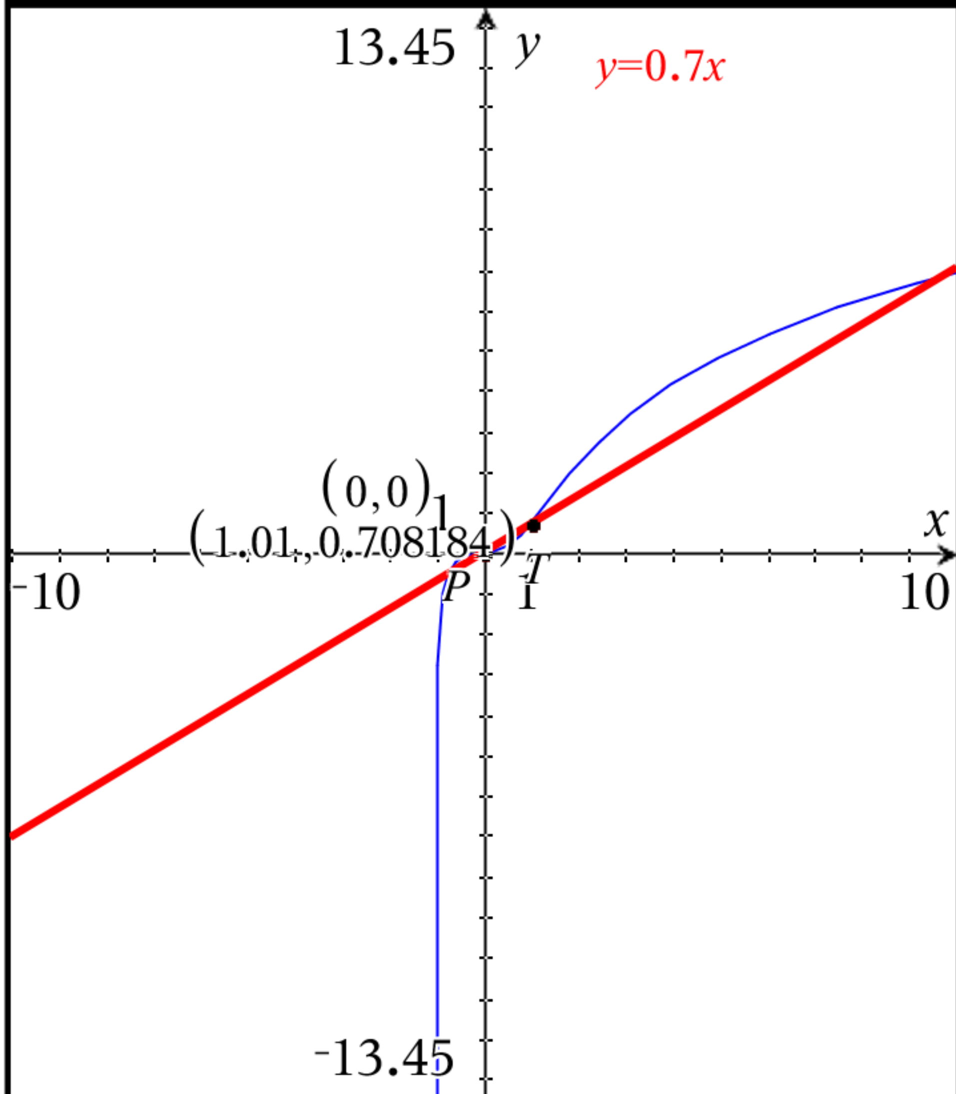
Secant line

Point Slope Form

$y = \ln(2)(x-0)+0$

Slope Intercept Form

$y\approx 0.69314718056\cdot x$



P = (0,0)

T = (1.01 ,0.708184057924)

Slope of PT =0.701172334578

Secant line

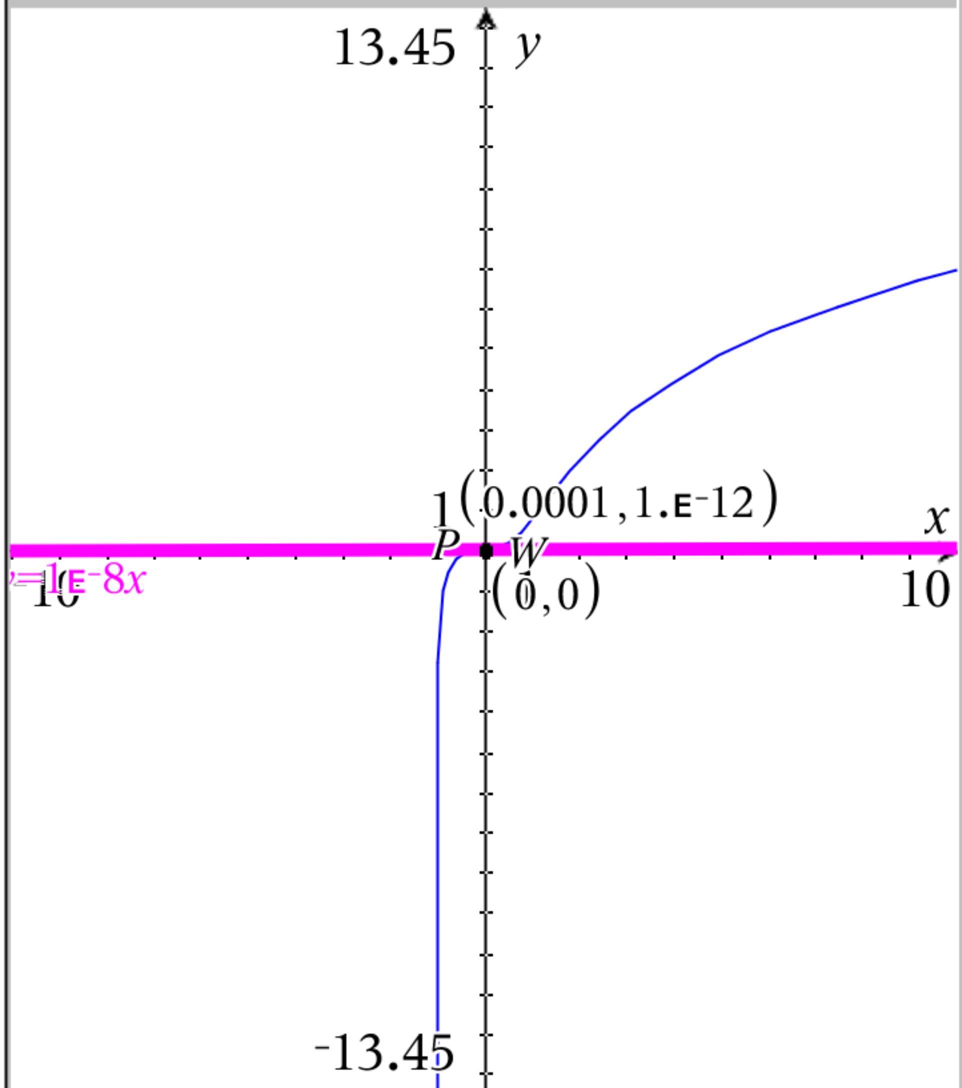
Point Slope Form

y = 0.701172334578 (x−0)+0

Slope Intercept Form

y =0.701172334578· x

$g(x)=\ln(1+x^3)$



$g(x)=\ln(1+x^3)$

P = (0,0)

W = (0.0001 ,1.E-12)

Slope of PW =0.00000001

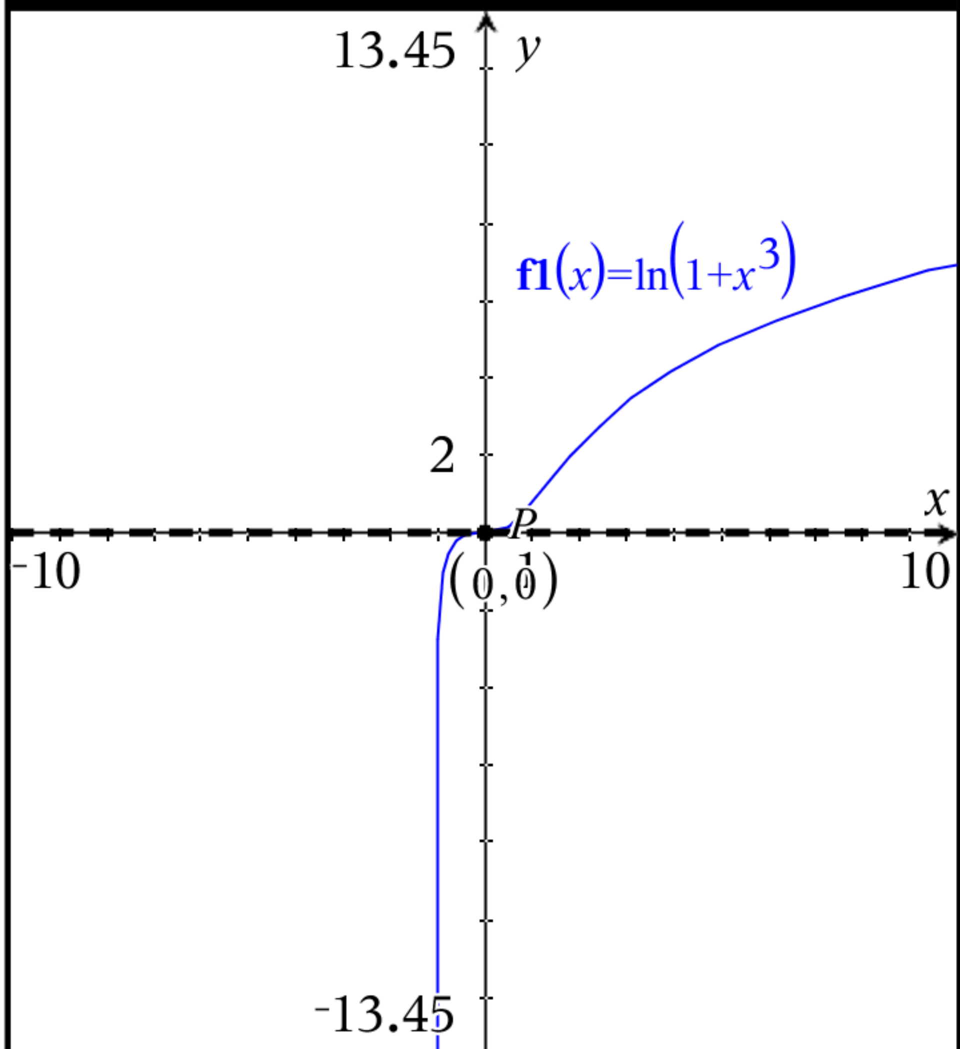
Secant line

Point Slope Form

y = 0.00000001 (x−0)+0

Slope Intercept Form

y =0.00000001 $\cdot x$



$g(x)=\ln(1+x^3)$

P = (0,0)

ACTUAL Tangent Line

Point Slope Form

y = 0 (x−0)+0

Slope Intercept Form

y =0

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 0$,

In my simple examples Q's x value was $x = 1$,

and it led to a slope of secant line through P and Q of $m = \ln(2) = 0.69314718056$

In my simple examples T's x value was $x = 1.01$,

and it led to a slope of secant line through P and T of $m = 0.701172334578$

In my simple examples W's x value was $x = 0.0001$,

and it led to a slope of secant line through P and W of $m = 0.00000001$

Say I took the time to find slope between P and one last value of C at $x = 0.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 0.$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = 0$ which is the the slope of the tangent line at $x = 0$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

$g(x) = \ln(x^3+1)$

P has x value 0 P has y value $g(0)=0$ P $(0,0)\approx$ P $(0.,0.)$

Q has x value 1 Q has y value $g(1)=\ln(2)$ Q $(1,\ln(2))\approx$ Q $(1.,0.69314718056)$

m of PQ = $\ln(2)\approx 0.69314718056$

T has x value 1.01 T has y value $g(1.01)=0.708184057924$ T $(1.01,0.708184057924)$

m of PT = 0.701172334578

W has x value 0.0001 W has y value $g(0.0001)=1.\text{E}^{-}12$ W $(0.0001,1.\text{E}^{-}12)$

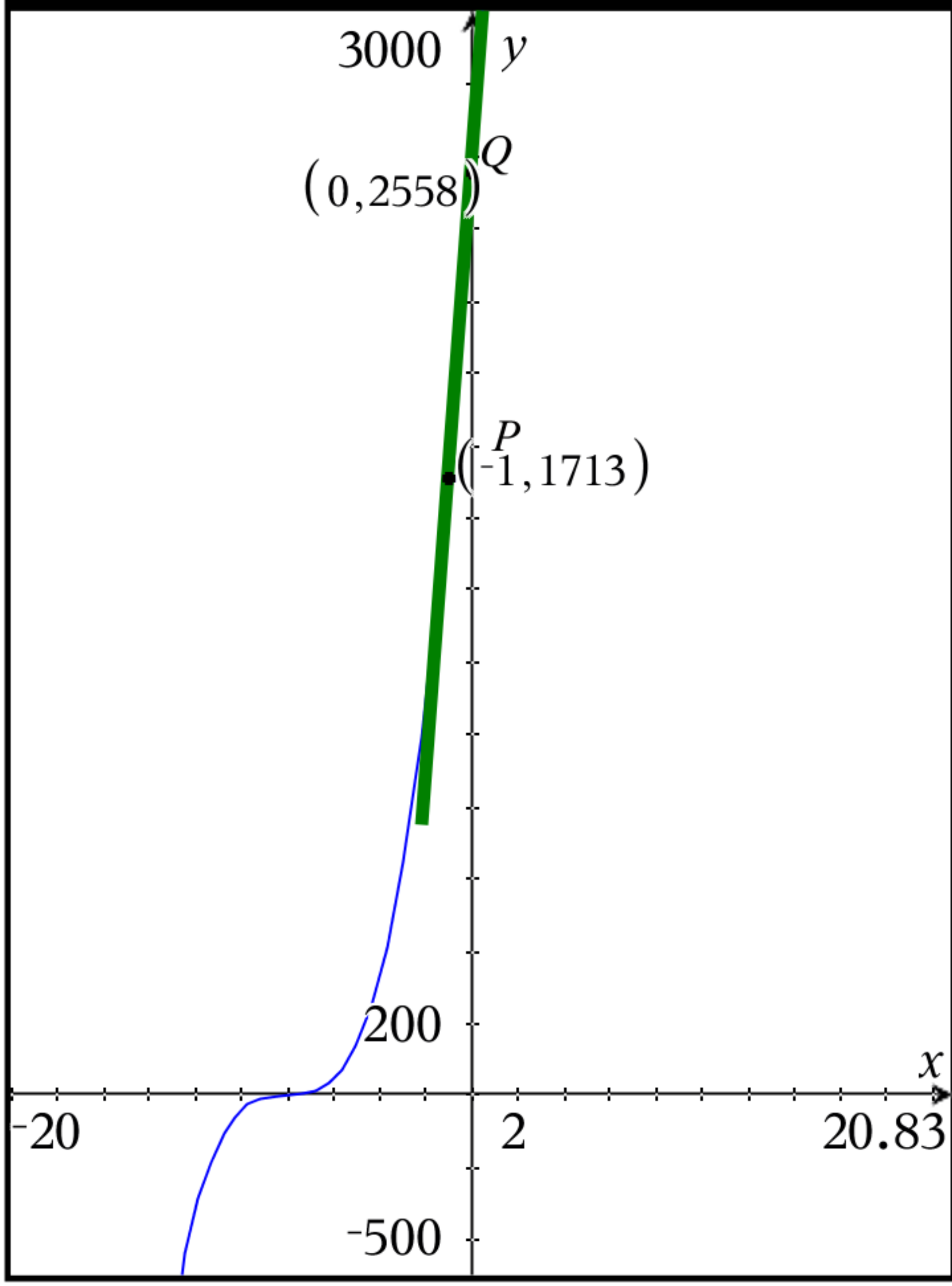
m of PW = 0.00000001

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 0 m tan = 0 SO as x $\rightarrow 0$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow 0$

	A	B	C	D x_1	E y_1	F x_2	G y_
=							
1	P	0	0	x_p	y_p	x_p	y_p
2	Q	1	ln(2)	x_q	y_q	x_t	y_t
3	m_pq	ln(2)	0.69314...				
4	change_y	ln(2)					
5	change_x	1					
6	T	1.01	0.70818...				
7	change_y	0.708184057924					
8	change_x	1.01					
9	m_pt	0.701172334578					
10	W	0.0001	1.E-12				
11	change_y	1.E-12					

B7 change_ypt:=y_t−y_p

Problem 1



$f(x) = 5(x+8)^3 - 2$

P = ($^-1$,1713)

Q = (0,2558)

Slope of PQ =845

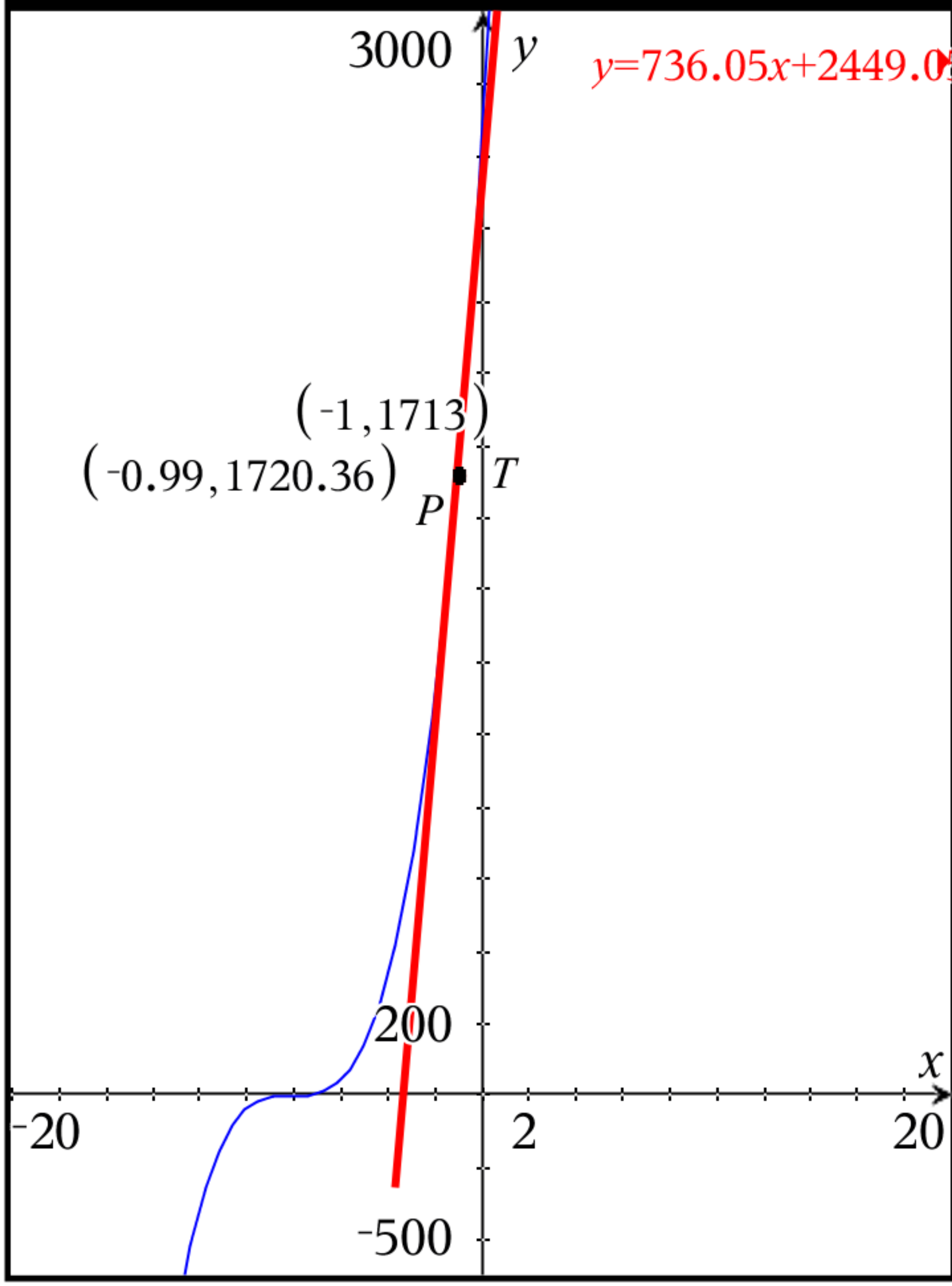
Secant line

Point Slope Form

y = 845 (x−$^-1$)+1713

Slope Intercept Form

$y=845 \cdot x+2558$



$f(x) = 5(x+8)^3 - 2$

P = (⁻1,1713)

T = (⁻0.99 ,1720.360505)

Slope of PT =736.0505

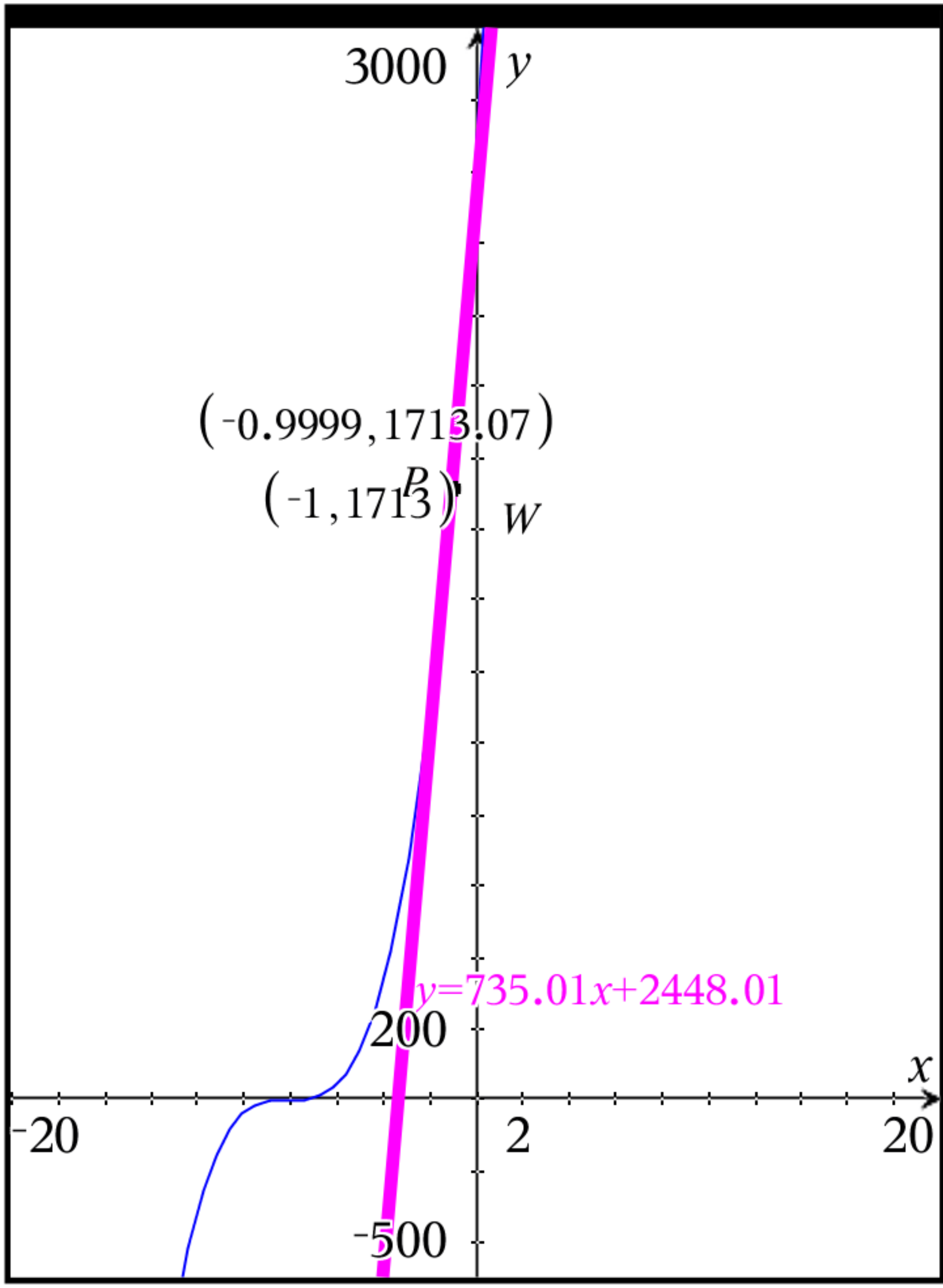
Secant line

Point Slope Form

y = 736.0505 (x−⁻1)+1713

Slope Intercept Form

y =736.0505·x+2449.0505



$f(x) = 5(x+8)^3 - 2$

P = (⁻1,1713)

W = (⁻0.9999 ,1713.07350105
)

Slope of PW =735.0105

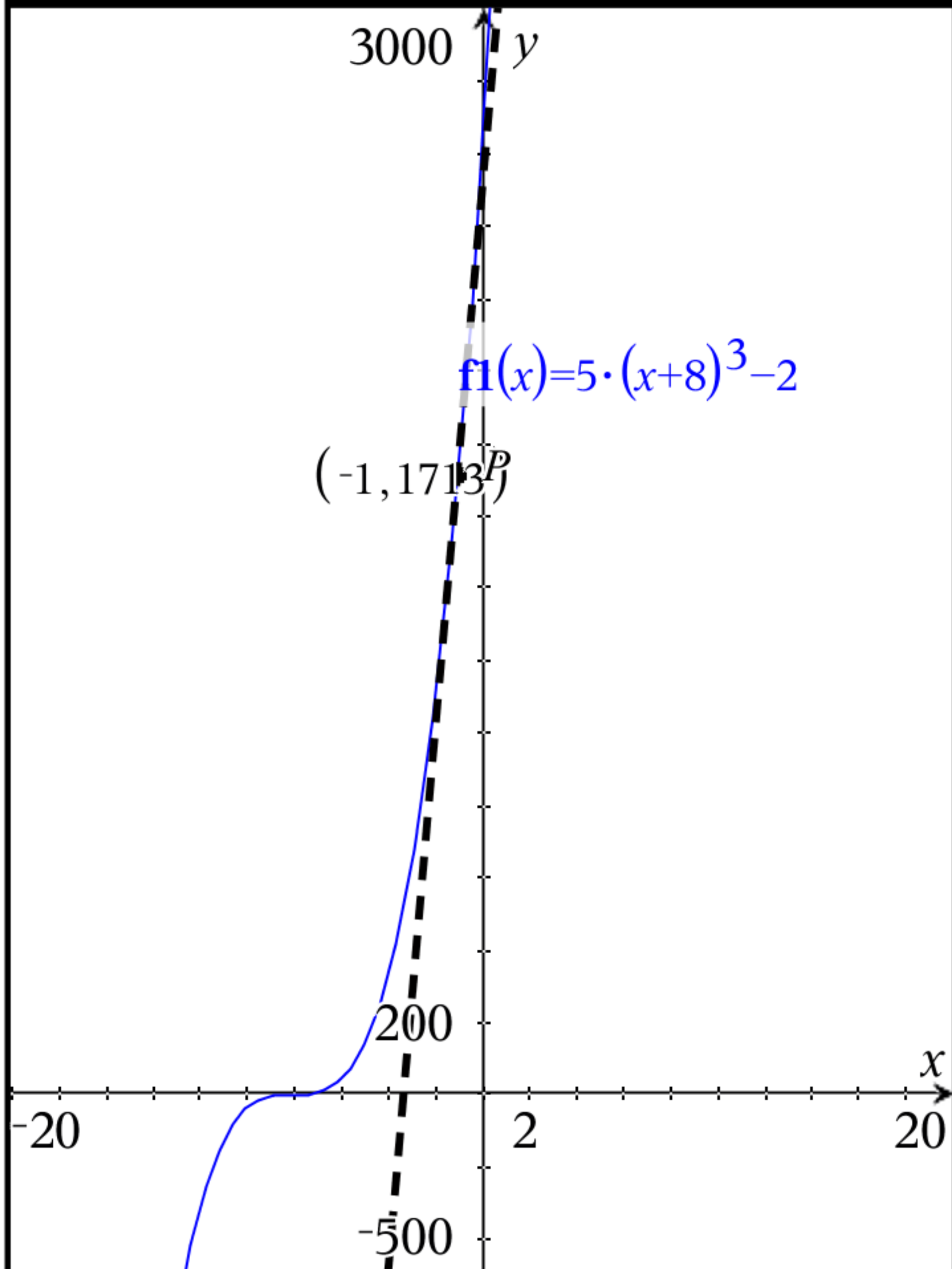
Secant line

Point Slope Form

y = 735.0105 (x−⁻1)+1713

Slope Intercept Form

$y = 735.0105 \cdot x + 2448.0105$



$f(x) = 5(x+8)^3 - 2$

P = $(^-1, 1713)$

ACTUAL Tangent Line

Point Slope Form

$y = 735(x - {^-1}) + 1713$

Slope Intercept Form

$y = 735 \cdot x + 2448$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = {}^{-}1$,

In my simple examples Q's x value was $x = 0$,

and it led to a slope of secant line through P and Q of $m = 845$

In my simple examples T's x value was $x = {}^{-}0.99$,

and it led to a slope of secant line through P and T of $m = 736.0505$

In my simple examples W's x value was $x = {}^{-}0.9999$,

and it led to a slope of secant line through P and W of $m = 735.0105$

Say I took the time to find slope between P and one last value of C at $x = {}^{-}0.99999999$

and it led to a slope of secant line through P and that point C of $m \approx 735.$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of m $= 735$ which is the the slope of the tangent line at $x = {}^{-}1$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1 - y2}{x1 - x2} = \frac{y2 - y1}{x2 - x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

$f(x) = 5\cdot x^3+120\cdot x^2+960\cdot x+2558$

P has x value $^-1$ P has y value f($^-1$)=1713 P ($^-1$,1713)

Q has x value 0 Q has y value f(0)=2558 Q (0 ,2558)

m of PQ = 845

T has x value $^-0.99$ T has y value f($^-0.99$)=1720.360505 T ($^-0.99$,1720.360505)

m of PT = 736.0505

W has x value $^-0.9999$ W has y value f($^-0.9999$)=1713.07350105 W ($^-0.9999$, 1713.07350105)

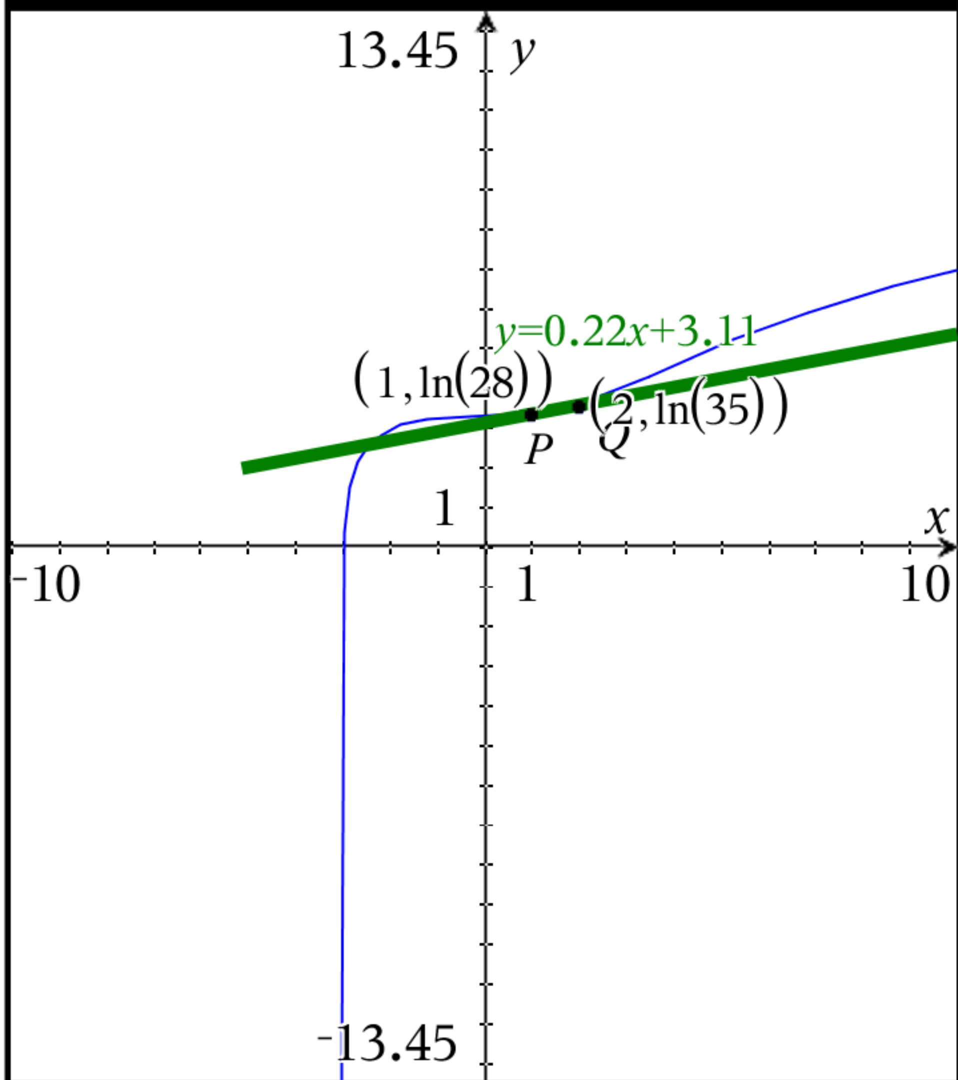
m of PW = 735.0105

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= $^-1$ m tan = 735 SO as x $\rightarrow$ $^-1$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow$ 735

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	-1	1713	x_p	y_p	x_p	y_p
2	Q	0	2558	x_q	y_q	x_t	y_t
3	m_pq	845	845.				
4	change_y	845					
5	change_x	1					
6	T	-0.99	1720.36...				
7	change_y	7.360505					
8	change_x	0.01					
9	m_pt	736.0505					
10	W	-0.9999	1713.07...				
11	change_y	0.07350105					

B2 x_q:=b1+1

Problem 1



g(x)=$\ln(27+x^3)$

P = $(1, \ln(28))$ ≈ $(1., 3.33220451018)$

Q = $(2, \ln(35))$ ≈ $(2., 3.55534806149)$

Slope of PQ = $\ln\left(\frac{5}{4}\right)$

≈0.223143551314

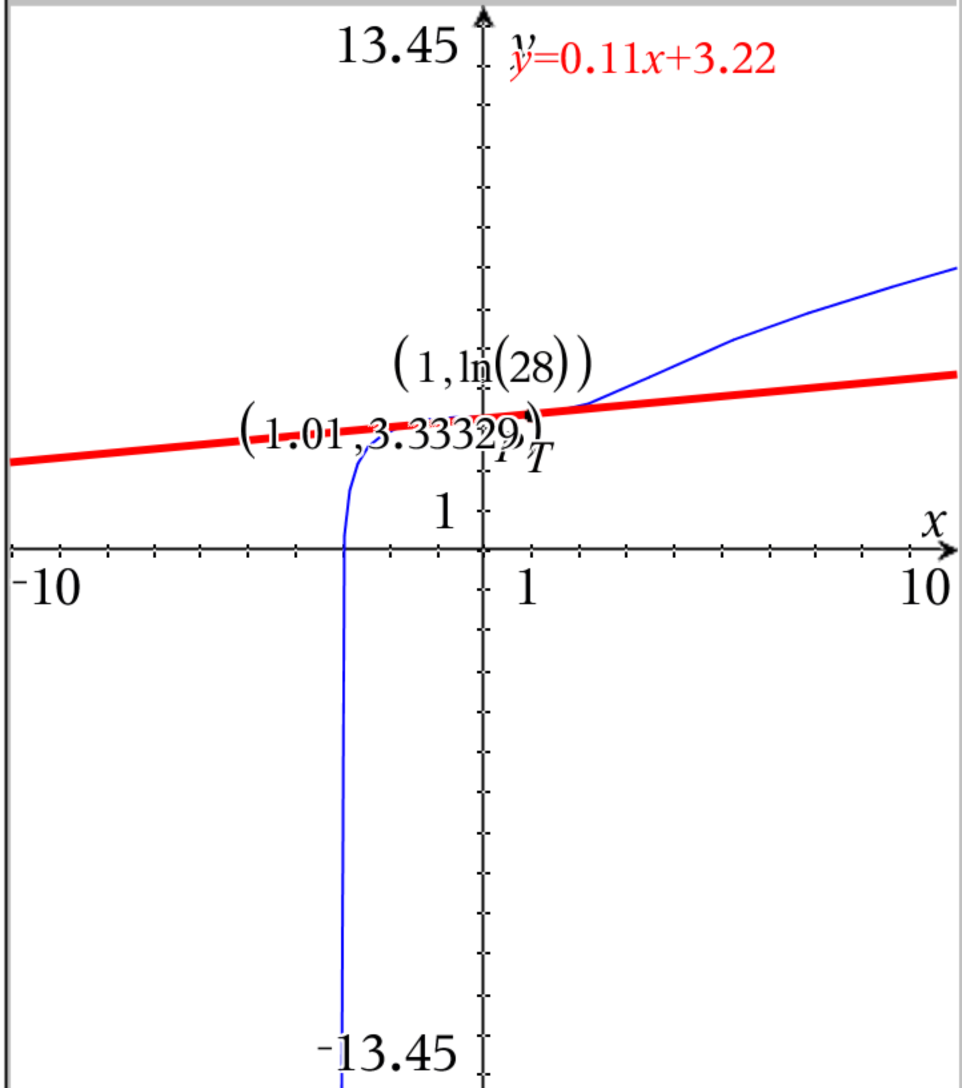
Secant line

Point Slope Form

y = $\ln\left(\frac{5}{4}\right)(x-1)+\ln(28)$

Slope Intercept Form

y≈0.223143551314$\cdot x$+3.10906095886



$g(x)=\ln\left(27+x^{3}\right)$

P = $\left(1,\ln(28)\right)$

T = $(1.01, 3.33328610361)$

Slope of PT = 0.10815934383

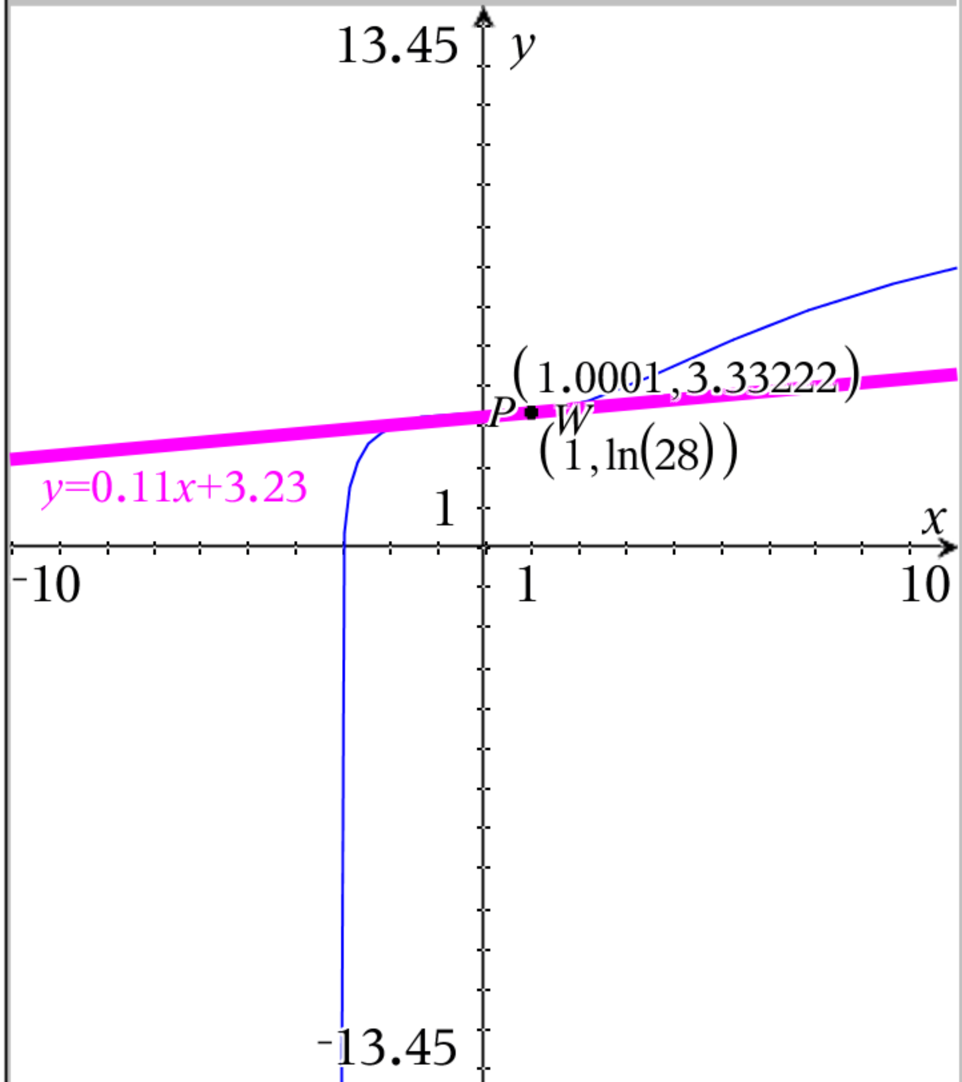
Secant line

Point Slope Form

$y = 0.10815934383\,(x-1)+\ln(28)$

Slope Intercept Form

$y = 0.10815934383\cdot x+3.22404516635$



$g(x)=\ln\left(27+x^3\right)$

P = $(1,\ln(28))$

W = $(1.0001\ ,3.33221522548\ )$

Slope of PW $=0.107152998$

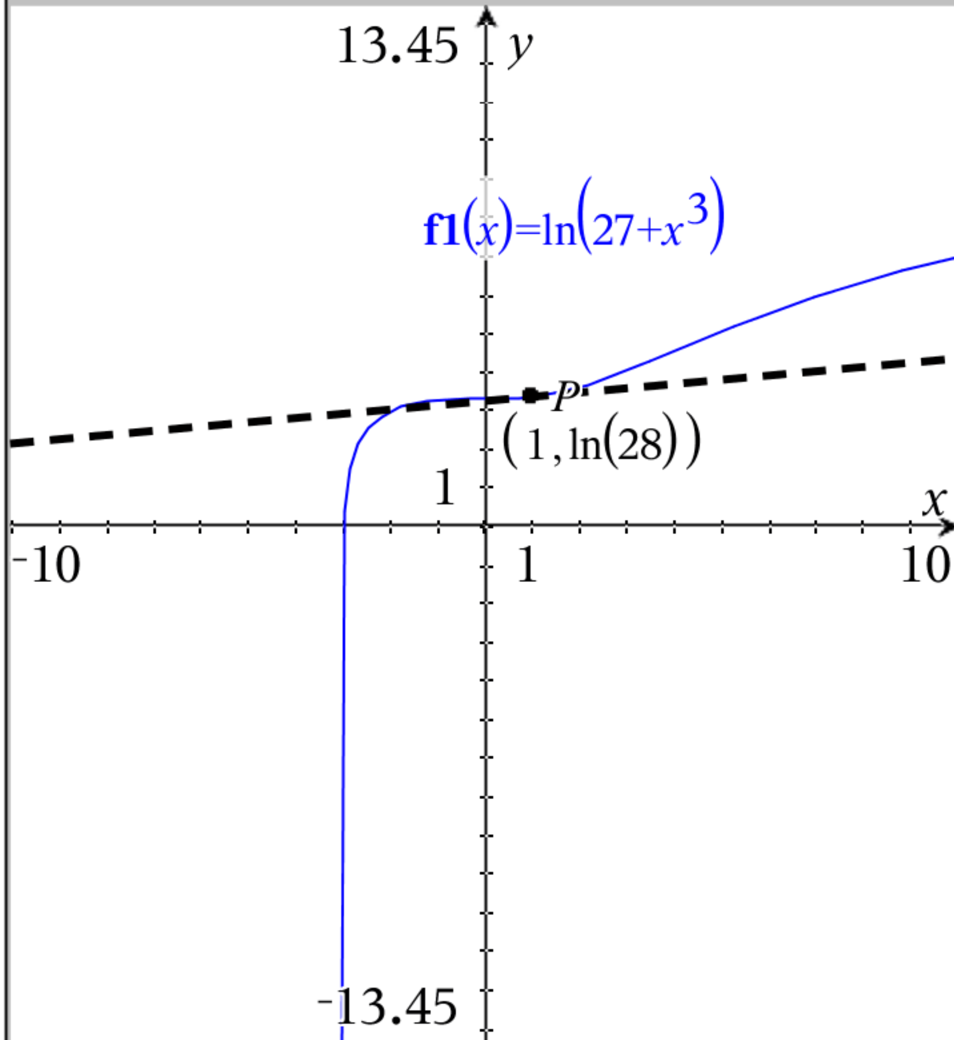
Secant line

Point Slope Form

$y = 0.107152998\ (x-1)+\ln(28)$

Slope Intercept Form

$y = 0.107152998 \cdot x + 3.22505151218$



$g(x)=\ln(27+x^3)$

$P = (1, \ln(28))$

ACTUAL Tangent Line

note $\frac{3}{28.} \approx 0.107142857143$

Point Slope Form

$$y = \frac{3}{28}(x-1)+\ln(28)$$

Slope Intercept Form

$$y = \frac{3 \cdot x}{28}+\ln(7)+2 \cdot \ln(2)-\frac{3}{28}$$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 1$,

In my simple examples Q's x value was $x = 2$,

and it led to a slope of secant line through P and Q of $m = \ln\left(\frac{5}{4}\right) = 0.223143551314$

In my simple examples T's x value was $x = 1.01$,

and it led to a slope of secant line through P and T of $m = 0.10815934383$

In my simple examples W's x value was $x = 1.0001$,

and it led to a slope of secant line through P and W of $m = 0.107152998$

Say I took the time to find slope between P and one last value of C at $x = 1.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 0.10714$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = \frac{3}{28}$ which

is the the slope of the tangent line at $x = 1$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

$g(x) = \ln\left(x^3+27\right)$

P has x value 1 P has y value $g(1)=\ln(28)$ P $(1, \ln(28))$ ≈P $(1., 3.33220451018)$

Q has x value 2 Q has y value $g(2)=\ln(35)$ Q $(2, \ln(35))$ ≈ Q $(2., 3.55534806149)$

m of PQ = $\ln\left(\frac{5}{4}\right) \approx 0.223143551314$

T has x value 1.01 T has y value $g(1.01)=3.33328610361$ T $(1.01, 3.33328610361)$

m of PT = 0.10815934383

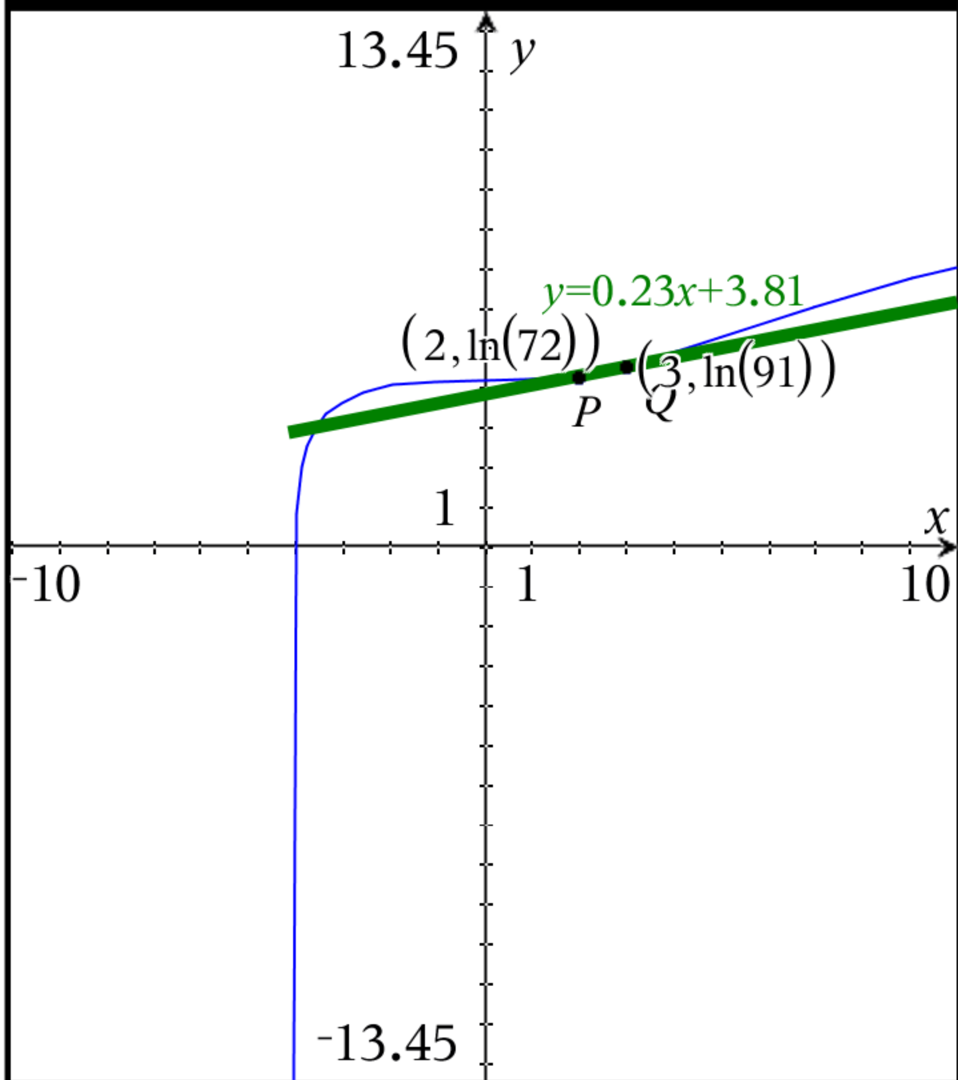
W hasx value1.0001 W hasy valueg$(1.0001)=3.33221522548$ W $(1.0001, 3.33221522548)$

m of PW = 0.107152998

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 1 m tan = $\frac{3}{28}$ SO as x $\rightarrow 1$ we can say that the slope of the tangent line and the instantaneous rate of change $\rightarrow \frac{3}{28}$

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	**1**	**ln(28)**	x_p	y_p	x_p	y_p
2	Q	**2**	**ln(35)**	x_q	y_q	x_t	y_t
3	m_pq	**ln(5/4)**	0.22314...				
4	change_y	**ln(5/4)**					
5	change_x	**1**					
6	T	**1.01**	**3.33328...**				
7	change_y	**0.001081593438**					
8	change_x	**0.01**					
9	m_pt	**0.10815934383**					
10	W	**1.0001**	**3.33221...**				
11	change_y	**0.0000107153**					

B2 $\mathbf{x\_q}:=b1+1$



g(x)=$\ln(64+x^3)$

P = $(2,\ln(72))$ ≈ $(2.,4.27666611902)$

Q = $(3,\ln(91))$ ≈ $(3.,4.51085950652)$

Slope of PQ = $\ln\left(\frac{91}{72}\right)$

≈0.234193387501

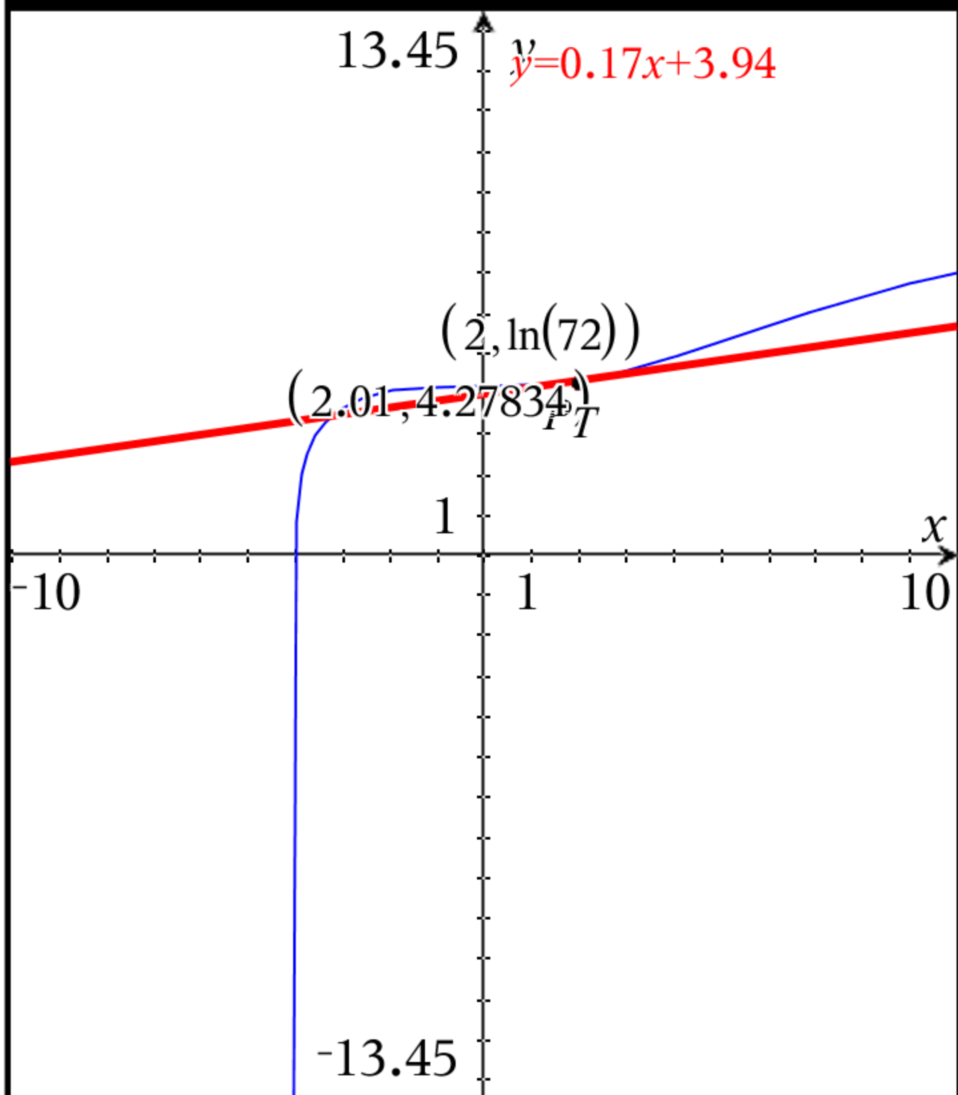
Secant line

Point Slope Form

y = $\ln\left(\frac{91}{72}\right)(x-2)+\ln(72)$

Slope Intercept Form

y≈$0.234193387501\cdot x+3.80827934401$



g(x)=$\ln(64+x^3)$

P = $(2, \ln(72))$

T = $(2.01, 4.27833973163)$

Slope of PT =0.16736126176

Secant line

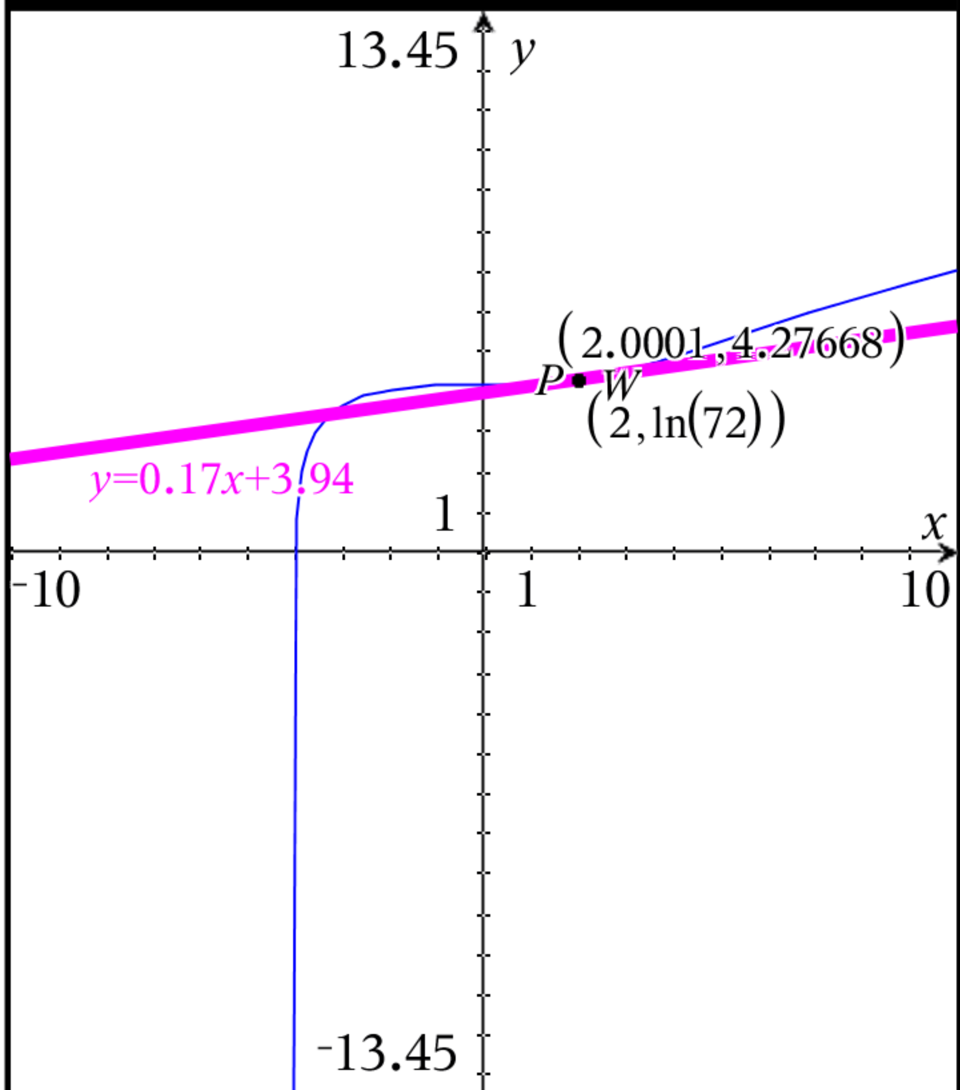
Point Slope Form

y = $0.16736126176\ (x-2)+\ln(72)$

Slope Intercept Form

y =$0.16736126176 \cdot x+$

3.9419435955



$g(x)=\ln(64+x^3)$

P = $(2,\ln(72))$

W = $(2.0001\ ,4.27668278638\ )$

Slope of PW =0.166673611

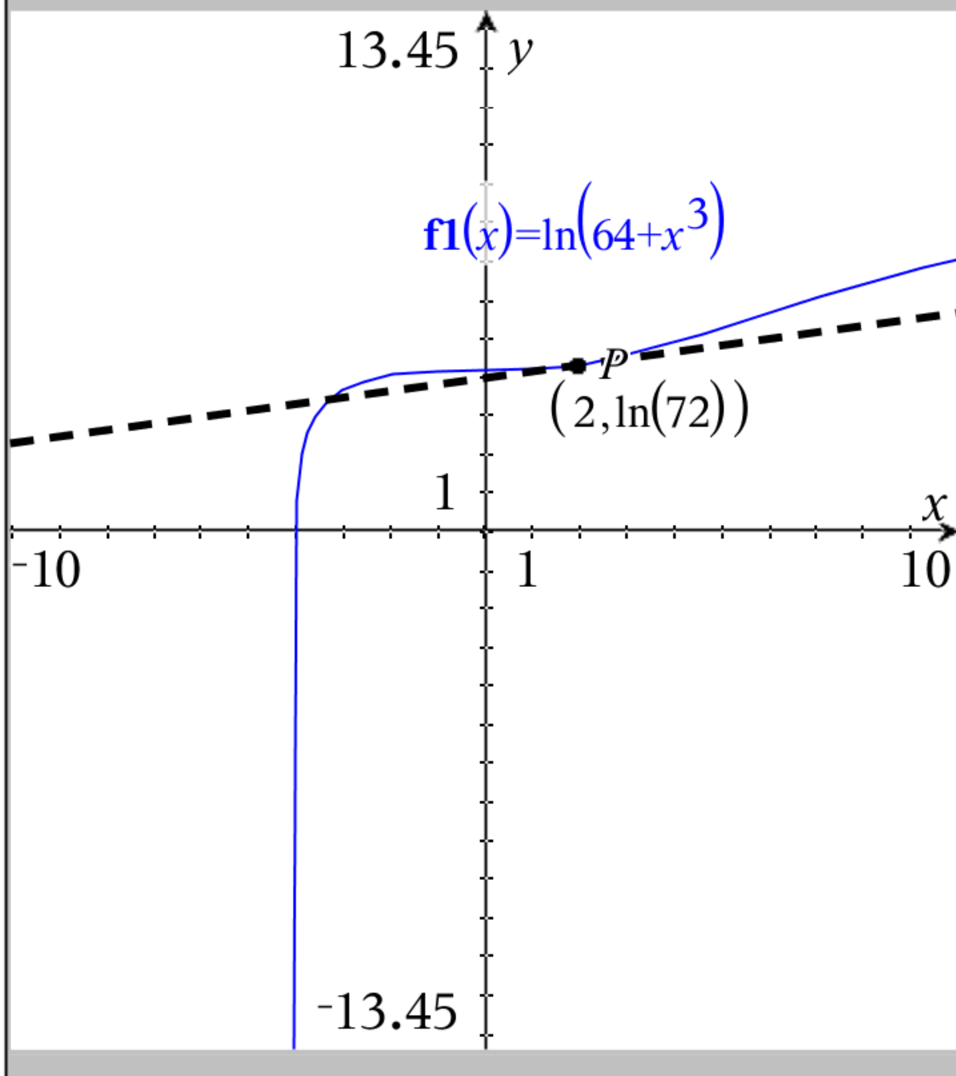
Secant line

Point Slope Form

y = $0.166673611\ (x-2)+\ln(72)$

Slope Intercept Form

y =$0.166673611\cdot x+3.94331889702$



g(x)=$\ln\left(64+x^3\right)$

P = $(2, \ln(72))$

ACTUAL Tangent Line

note $\frac{3}{65.} \approx 0.046153846154$

Point Slope Form

$$y = \frac{1}{6}(x-2)+\ln(72)$$

Slope Intercept Form

$$y = \frac{x}{6}+2\cdot \ln(3)+3\cdot \ln(2)-\frac{1}{3}$$

In this case as we pick values of x that are getting increasingly closer and closer

to P's x value namely $x = 2$,

In my simple examples Q's x value was $x = 3$,

and it led to a slope of secant line through P and Q of $m = \ln\left(\frac{91}{72}\right) = 0.234193387501$

In my simple examples T's x value was $x = 2.01$,

and it led to a slope of secant line through P and T of $m = 0.16736126176$

In my simple examples W's x value was $x = 2.0001$,

and it led to a slope of secant line through P and W of $m = 0.166673611$

Say I took the time to find slope between P and one last value of C at $x = 2.00000001$

and it led to a slope of secant line through P and that point C of $m \approx 0.16666$

(accurate to 12 decimals)

It appears that the slopes of the secant lines are pointing towards a slope of the tangent line of $m = \frac{1}{6}$ which is

the the slope of the tangent line at $x = 2$

Steps in this process

1) find an x value that you are planning to use as one of the points in a secant line

2) determine that point's y coordinate

You now know (x1,y1)

3) pick an x coordinate that is approaching x from step 1

4) determine that point's y coordinate

You now know (x2,y2)

5) find slope of the secant line

$$m = \frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$$

This slope of the secant line is also called the average rate of change from x1 to x2

Now if we fix x_1 and let another x coordinate, say x3, that gets closer to x1

and repeat steps 1 through 5 with the "new x3", then the new slope of the secant line will be a better approximation of the slope of the tangent line and ultimately that average rate of change between x1 and x3 will get closer to the instantaneous rate of change at x1

g(x) = $\ln\left(x^3+64\right)$

P has x value 2 P has y value g(2)=$\ln(72)$ P (2,$\ln(72)$) ≈P ($2.$,4.27666611902)

Q has x value 3 Q has y value g(3)=$\ln(91)$ Q (3,$\ln(91)$) ≈ Q ($3.$,4.51085950652)

m of PQ = $\ln\left(\frac{91}{72}\right) \approx 0.234193387501$

T has x value 2.01 T has y value g(2.01)=4.27833973163 T (2.01,4.27833973163)

m of PT = 0.16736126176

W hasx value2.0001 W hasy valueg(2.0001)=4.27668278638 W (2.0001,4.27668278638)

m of PW = 0.166673611

The actual tangent line's slope and the instantaneous rate of change is not found until we can either evaluate a limit properly or we learn how the derivative of a function works, but since I do know how to do these things I'll give you this slope and ultimately the instantaneous rate of change at x= 2 m tan = $\frac{1}{6}$ SO as x $\to 2$ we can say that the slope of the tangent line and the instantaneous rate of change $\to \frac{1}{6}$

	A	B	C	D x_1	E y_1	F x_2	G y_2
=							
1	P	**2**	**ln(72)**	x_p	y_p	x_p	y_p
2	Q	**3**	**ln(91)**	x_q	y_q	x_t	y_t
3	m_pq	**ln(91/72)**	0.23419...				
4	change_y	**ln(91/72)**					
5	change_x	**1**					
6	T	**2.01**	**4.27833...**				
7	change_y	**0.001673612618**					
8	change_x	**0.01**					
9	m_pt	**0.16736126176**					
10	W	**2.0001**	**4.27668...**				
11	change_y	**0.000016667361**					

B2 **x_q**:=*b1*+1