MAPLE ASSIGNMENT 1

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1. a)

> $d := t \rightarrow \frac{9\,t}{t^2 + 9}$

$$d := t \mapsto \frac{9 \cdot t}{t^2 + 9} \quad \textbf{(1)}$$

b) Instantaneous velocity is lim as t approaches a of f=(d(t)-d(a))/t-a

> $f := t \rightarrow \frac{(d(t) - d(1))}{t - 1}$

$$f := t \mapsto \frac{d(t) - d(1)}{t - 1} \quad \textbf{(2)}$$

> $evalf(f(.9))$

$$0.7431192660 \quad \textbf{(3)}$$

> $evalf(f(.99))$

$$0.7223374500 \quad \textbf{(4)}$$

> $evalf(f(.999))$

$$0.7202340000 \quad \textbf{(5)}$$

> $evalf(f(1.1))$

$$0.6963760980 \quad \textbf{(6)}$$

> $evalf(f(1.01))$

$$0.7176574800 \quad \textbf{(7)}$$

> $evalf(f(1.001))$

$$0.7197660000 \quad \textbf{(8)}$$

Prediction: Instantaneous velocity at 1s is .72 ft/s...Check:

> $\lim_{t \rightarrow 1} (f(t))$

$$\frac{18}{25} \quad \textbf{(9)}$$

> $evalf\left(\frac{18}{25}\right)$

$$0.7200000000 \quad \textbf{(10)}$$

Velocity after 1 second is 0.72 ft/s

c)

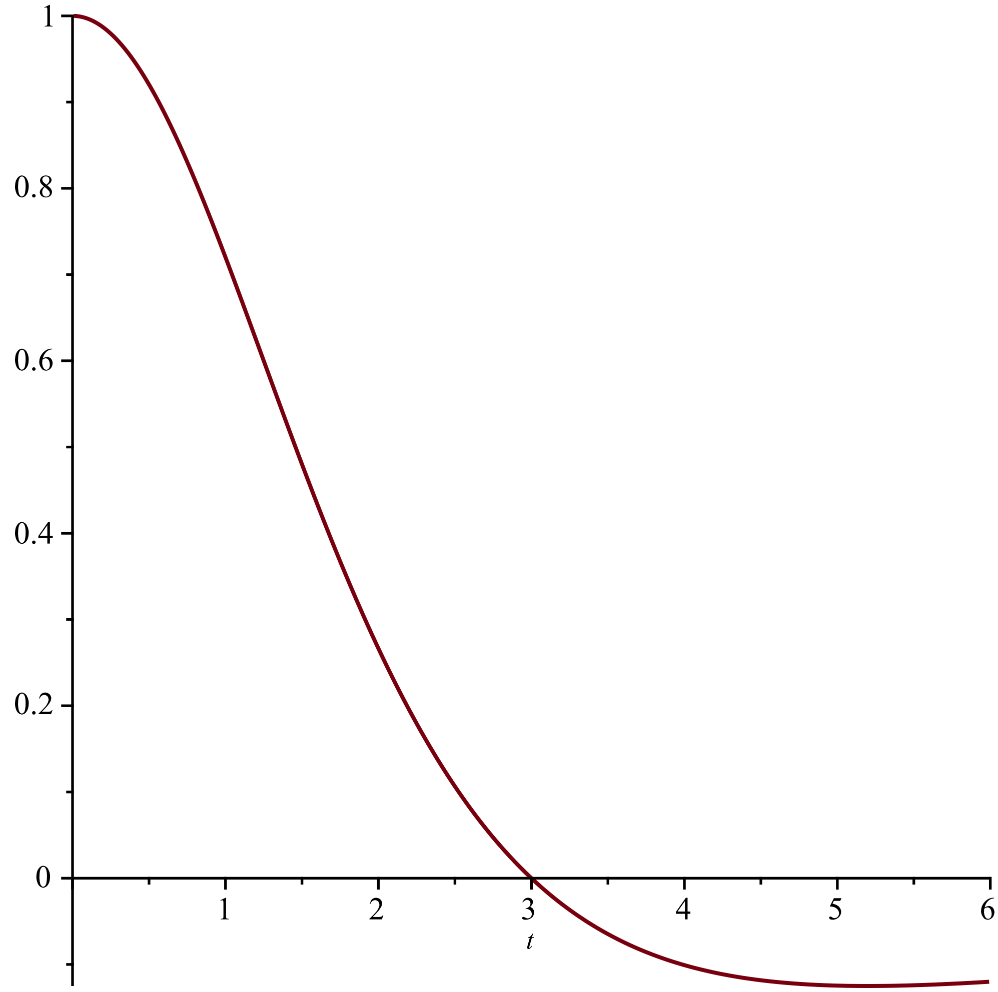
> $solve(\mathrm{D}(d)(t) = 0, t)$

$$-3, 3 \quad \textbf{(11)}$$

The particle is at rest at both t=3 and t=-3, but we can discard t=-3 because it is impossible to have a negative time.

d)

> $plot(\mathrm{D}(d)(t), t = 0..6)$



The particle seems to be speeding up from t=0 to t=3 and slowing down when 3<t<6.

2. a)

> $f := x \rightarrow \frac{1}{\sqrt{2x+3}}$

$$f := x \mapsto \frac{1}{\sqrt{2 \cdot x + 3}} \quad \textbf{(12)}$$

b)

> $\mathrm{D}(f)(x)$

$$-\frac{1}{(2x+3)^{3/2}} \quad \textbf{(13)}$$

> $f'(3)$

$$-\frac{\sqrt{9}}{81} \quad (14)$$

> $f(3)$

$$\frac{1}{3} \quad (15)$$

> $y = -\frac{\sqrt{9}}{81}(x-3) + \frac{1}{3}$

$$y = -\frac{x}{27} + \frac{4}{9} \quad (16)$$

> $L := x \rightarrow -\frac{x}{27} + \frac{4}{9}$

$$L := x \mapsto -\frac{x}{27} + \frac{4}{9} \quad (17)$$

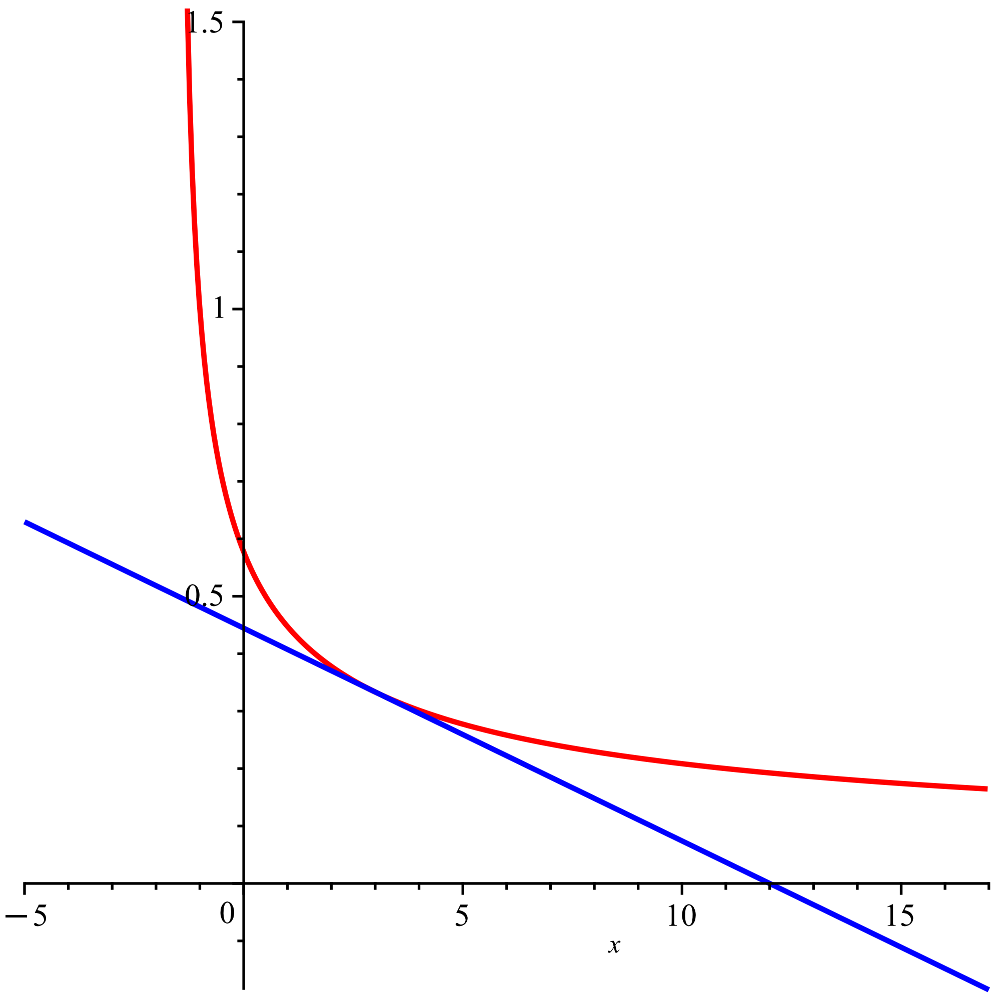
c)

> $with(plots):$

> $Plot1 := plot(f(x), color = red, thickness = 2):$

> $Plot2 := plot(L(x), color = blue, thickness = 2):$

> $display(Plot1, Plot2)$

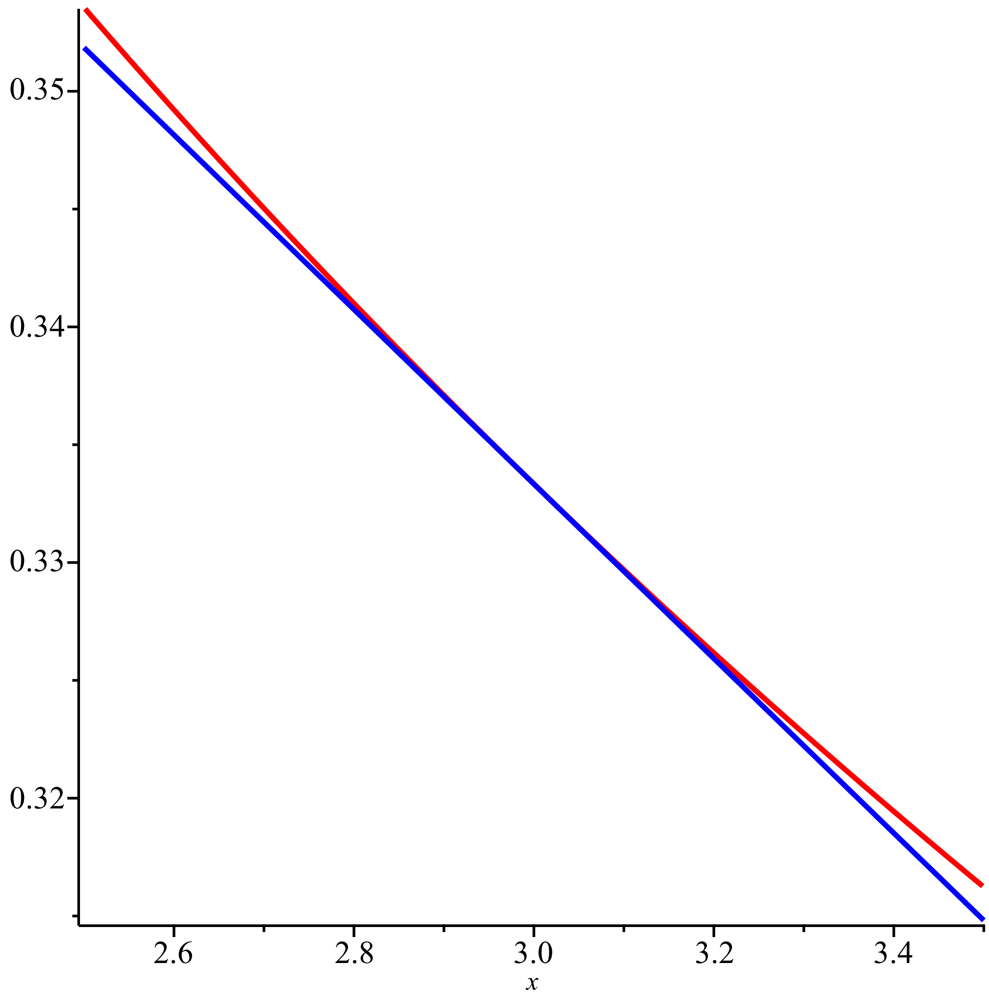


d) i.

> $Plot1 := plot(f(x), x = 2.5 ..3.5, color = red, thickness = 2)$:

> $Plot2 := plot(L(x), x = 2.5 ..3.5, color = blue, thickness = 2)$:

> $display(Plot1, Plot2)$



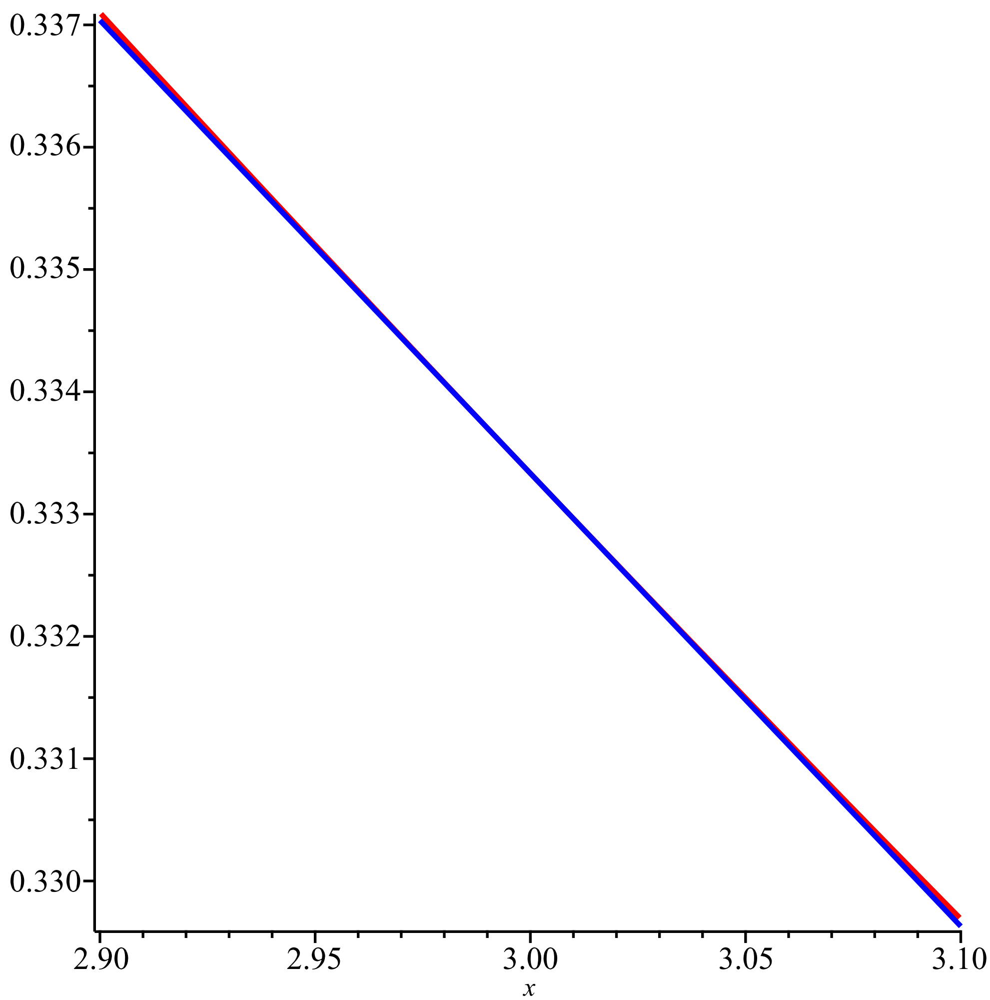
>

ii.

> $Plot1 := plot(f(x), x = 2.9 ..3.1, color = red, thickness = 2)$:

> $Plot2 := plot(L(x), x = 2.9 ..3.1, color = blue, thickness = 2)$:

> $display(Plot1, Plot2)$



As we zoom in closer to the point (3,f(3)), we notice that the graph of f(x) and the tangent line seem to overlap.

e)

> $eval(|f(3.1) - L(3.1)|)$

$$0.0000606071 \tag{18}$$

>

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