$with(Student[Calculus1]);$

$[AntiderivativePlot, AntiderivativeTutor, ApproximateInt, ApproximateIntTutor, ArcLength, ArcLengthTutor, Asymptotes, Clear, CriticalPoints, CurveAnalysisTutor, DerivativePlot, DerivativeTutor, DiffTutor, ExtremePoints, FunctionAverage, FunctionAverageTutor, FunctionChart, FunctionPlot, GetMessage, GetNumProblems, GetProblem, Hint, InflectionPoints, IntTutor, Integrand, InversePlot, InverseTutor, LimitTutor, MeanValueTheorem, MeanValueTheoremTutor, NewtonQuotient, NewtonsMethod, NewtonsMethodTutor, PointInterpolation, RiemannSum, RollesTheorem, Roots, Rule, Show, ShowIncomplete, ShowSolution, ShowSteps, Summand, SurfaceOfRevolution, SurfaceOfRevolutionTutor, Tangent, TangentSecantTutor, TangentTutor, TaylorApproximation, TaylorApproximationTutor, Understand, Undo, VolumeOfRevolution, VolumeOfRevolutionTutor, WhatProblem]$ **(1)**

Chapter 2 Section 1 Problem 6(modified) If a rock is thrown upward on the planet Mars with a velocity of 10 m/s, its height in meters t seconds later is given by f(t) = 10t - 1.86t^2.

(a) Find the average velocity over the given time intervals: (i) [1,2] , (ii) [1,1.5] , (iii) [1,1.1] , (iv) [1, 1.01] , (v) [1,1.001]

$GetSlope := \mathbf{proc}(x1, y1, x2, y2)\ evalf\left(\frac{(y2 - y1)}{x2 - x1}\right)\ \mathbf{end\ proc};$

$$\mathbf{proc}(x1, y1, x2, y2)\ \ evalf((y2 - y1)/(x2 - x1))\ \ \mathbf{end\ proc} \qquad \textbf{(2)}$$

$f := t \rightarrow 10 \cdot t - 1.86\, t^2;$

$$t \rightarrow 10\, t + (-1) \cdot 1.86\, t^2 \qquad \textbf{(3)}$$

$GetSlope(1, f(1), 2, f(2));$

$$4.42 \qquad \textbf{(4)}$$

$GetSlope(1, f(1), 1.5, f(1.5));$

$$5.350000000 \qquad \textbf{(5)}$$

$GetSlope(1, f(1), 1.1, f(1.1));$

$$6.094000000 \qquad \textbf{(6)}$$

$GetSlope(1, f(1), 1.01, f(1.01));$

$$6.261400000 \qquad \textbf{(7)}$$

$GetSlope(1, f(1), 1.001, f(1.001));$

$$6.278140000 \qquad \textbf{(8)}$$

(b) Estimate the instantaneous velocity when t = 1. 6.28

(c*) Using the slope from part (b), find an equation of the tangent line to the curve at P(1,f(1))

$f(1)$

$$8.14 \qquad \textbf{(9)}$$

equation of tangent line is y - 8.14 = 6.28(x - 1)

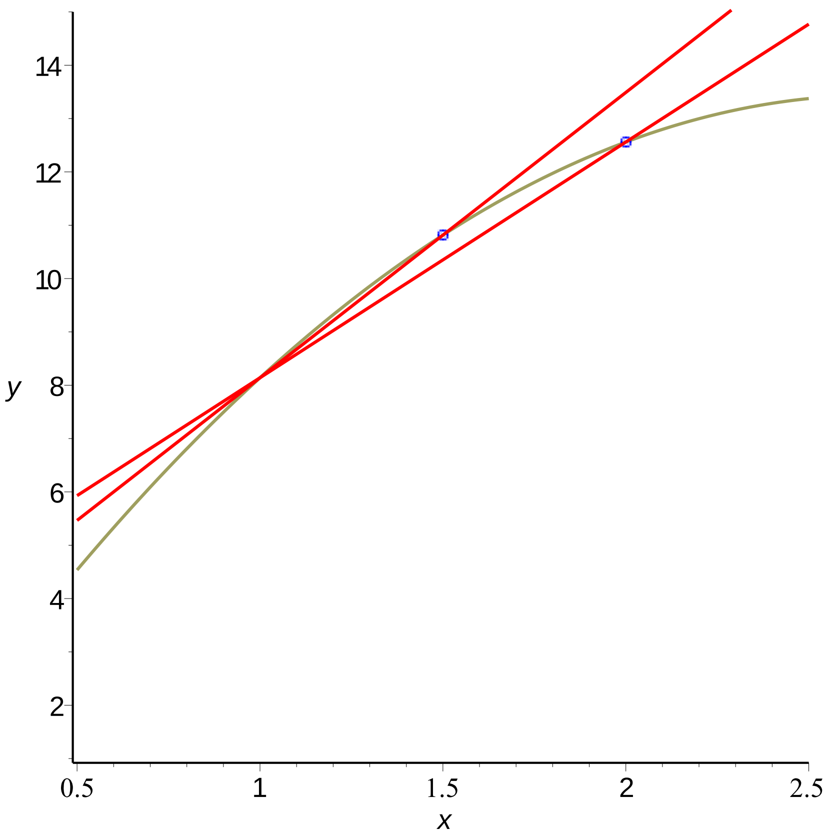
(d*) Sketch the curve, two of the secant lines, and the tangent.

$DrawSec := \mathbf{proc}(f, x1, xlist, xrange :: range, yrange :: range)\ \mathbf{local}\ i, z, P, M, coords, sec1;\ M := x \rightarrow x;$
$P := map([M, f], \mathrm{xlist});\ \mathrm{coords} := plot(P, xrange, style = point, color = blue, symbol = circle);\ i$
$:= z \rightarrow (GetSlope(x1, f(x1), z, f(z))) \cdot (x - x1) + f(x1);\ sec1 := map(i, xlist);$

```
plots[display]([plot([[x1, f(x1)]], style = point, color = black, symbol = box), plot(f, xrange,
yrange, color = khaki), coords, plot(sec1, x = xrange, y = yrange, color = red)]); end proc
```

```
proc(f, x1, xlist, xrange::range, yrange::range)                                    (10)
    local i, z, P, M, coords, sec1;
    M := x → x;
    P := map([M, f], xlist);
    coords := plot(P, xrange, style = point, color = blue, symbol = circle);
    i := z → GetSlope(x1, f(x1), z, f(z)) * (x − x1) + f(x1);
    sec1 := map(i, xlist);
    plots[display]([plot([[x1, f(x1)]], style = point, color = black, symbol = box), plot(f,
    xrange, yrange, color = khaki), coords, plot(sec1, x = xrange, y = yrange, color = red)])
end proc
```

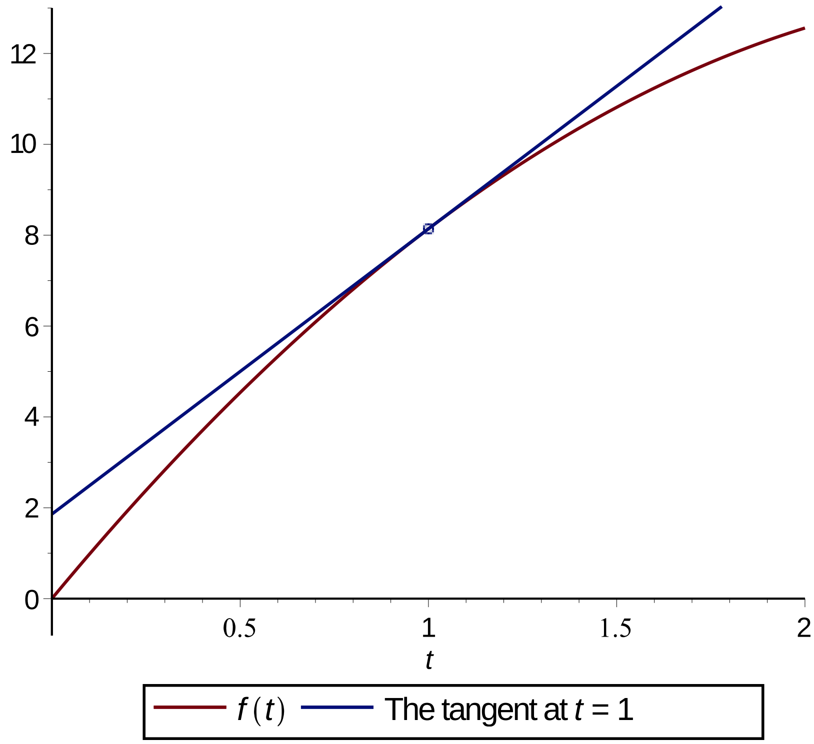
$DrawSec(f, 1, [1.5, 2], .5 ..2.5, 1 ..15);$



$Tangent(10\cdot t - 1.86\cdot t^2, t = 1);$

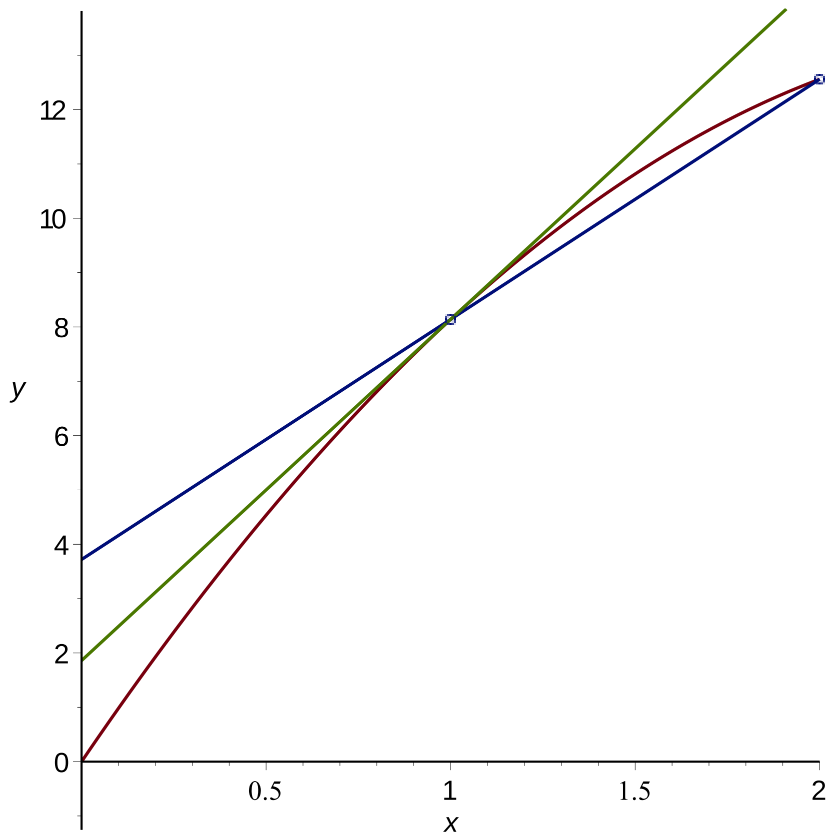
$$6.28\, t + 1.86 \quad (11)$$

$Tangent(10\cdot t - 1.86\cdot t^2, t = 1, output = plot);$



At $t = 1$, for the function $f(t) = 10\,t - 1.86\,t^2$, a graph of $f(t)$ and a tangent line.

$TangentTutor\left(10\cdot t - 1.86\cdot t^2,\ t = 1\right);$



y
12
10
8
6
4
2
0
0.5
1
1.5
2
x