2009testonesample.mw
Maple 10 Worksheet for Problems in Math 165 - Calculus for Business.

First load plots and student:

```
> restart: with( student):with (plots):
```

N.B. A Maple command such as eval(f(x),x=2) is the instruction
``Evaluate f(2)" or
``evaluate the function f(x) at x = 2."
a:= b assigns the value 'b' to the name 'a'
Use a semicolon ; to execute a 'Maple Command' and display the output.
Using a colon : executes a command without displaying the output.
I (JL) usually write functions as a procedure such as the "x square funtion:
 square_function:= proc(x);x^2 ; end proc;
Other ways to write functions:
 square_function:= x -> x^2;
`%` is the last computed expression (Simlar to ANS on your calculator.

1.

```
> f_1:= proc(x); 1/x; end proc:`f_1(x) `:= f_1(x);
> answer_1:= f_1(x + 9);
```

$$f\_1(x) := \frac{1}{x}$$

$$answer\_1 := \frac{1}{x+9} \qquad (1)$$

```
>
```

2. Intersection WRONG ANSWER;
 Maple calcuates the roots as rational expressions unless forced to use decimals

```
> eqn:= x^2 = 10*x +3;
  x_point:= solve(x^2 = 10*x +3,x);root_1:=x_point[1];root_2:=
  x_point[2];
  answer_2:=[[root_1,root_1^2],[root_2,root_2^2]];
> x_point:= solve(x^2 = 10*x +3.,x);root_1:=x_point[1];root_2:=
  x_point[2];
  answer_2:=[[root_1,root_1^2],[root_2,root_2^2]];
```

$$eqn := x^2 = 10\,x + 3$$

$$x\_point := 5 + 2\sqrt{7},\, 5 - 2\sqrt{7}$$

$$root\_1 := 5 + 2\sqrt{7}$$

$$root\_2 := 5 - 2\sqrt{7}$$

$$answer\_2 := \left[\left[5 + 2\sqrt{7},\, \left(5 + 2\sqrt{7}\right)^2\right], \left[5 - 2\sqrt{7},\, \left(5 - 2\sqrt{7}\right)^2\right]\right]$$

$$x\_point := 10.29150262, -.2915026222$$

$$root\_1 := 10.29150262$$

$$root\_2 := -.2915026222$$

(2)

$answer\_2 := [[10.29150262, 105.9150262], [-.2915026222, 0.08497377875]]$ (2)

3. LINEAR PRICE DEMAND
q = 60 - (2 per 100) (p - 1800) = 60 + 36 - .02p . Maximumoccurs midway between roots of quadrativ.

```
> Demand:= p -> 96 - .02*p;`Demand(p) `:= Demand(p);
> Revenue:= p -> p*Demand(p);`Revenue(p) `:=Revenue(p);
> answer_3:= (0 + 96/.02)/2;
```

$$Demand := p \to 96 - 0.02\, p$$

$$Demand(p) := 96 - 0.02\, p$$

$$Revenue := p \to p\, Demand(p)$$

$$Revenue(p) := p\, (96 - 0.02\, p)$$

$$answer\_3 := 2400.000000 \quad (3)$$

4.

```
> C:= t -> 325 + 45*t;answer_4:= C(10);
```

$$C := t \to 325 + 45\, t$$

$$answer\_4 := 775 \quad (4)$$

5. Solve C_1 = C_2 for m

```
> C_1:= proc(d,m);40*d + .30*m; end proc:`C_1 `:= C_1(d,m);
  C_2:= proc(d,m);25*d + .50*m; end proc:`C_2 `:= C_2(d,m);
  answer_5:=solve(C_1(5,m) = C_2(5,m),m);
```

$$C\_1 := 40\, d + 0.30\, m$$

$$C\_2 := 25\, d + 0.50\, m$$

$$answer\_5 := 375. \quad (5)$$

6

```
> simplify((x + 2)/(x^2 -4));
  answer_6:= limit((x + 2)/(x^2 -4), x = -2);
```

$$\frac{1}{x-2}$$

$$answer\_6 := -\frac{1}{4} \quad (6)$$

7. Discontinuos or not defined when denominator =o

```
> answer_7:= solve(x^2 + x =0,x);
```

$$answer\_7 := 0, -1 \quad (7)$$

8. C

```
> f_8:= proc(x);5/x^2; end proc:`f_8(x) `:=f_8(x);
  dquotient:=(f_8(x + h) - f_8(x))/h;
  answer_8:= simplify(dquotient);deriv:=limit(%, h = 0);
```

$$f\_8(x) := \frac{5}{x^2}$$

$$dquotient := \frac{\frac{5}{(x+h)^2} - \frac{5}{x^2}}{h}$$

$$answer\_8 := -\frac{5\,(2\,x+h)}{(x+h)^2\,x^2}$$

$$deriv := -\frac{10}{x^3} \qquad (8)$$

9.

```
> f_9:= proc(x); x^2/ (x - 2) ; end proc;`f_9(x) `:=f_9(x);
  answer_9 := diff(f_9(x),x);`normalized answer `:=normal(%);
```

$$f\_9 := \mathbf{proc}(x)\ x\hat{}2\,/\,(x-2)\ \mathbf{end\ proc}$$

$$f\_9(x) := \frac{x^2}{x-2}$$

$$answer\_9 := \frac{2\,x}{x-2} - \frac{x^2}{(x-2)^2}$$

$$normalized\ answer := \frac{x\,(x-4)}{(x-2)^2} \qquad (9)$$

10.

```
> f_10 := proc(t);4/ (6*t + 3) ; end proc:`f_10(t) `:=f_10(t);
  first_deriv:= diff(f_10(t),t);
  second_deriv:= diff(%, t);
```

$$f\_10(t) := \frac{4}{6\,t+3}$$

$$first\_deriv := -\frac{24}{(6\,t+3)^2}$$

$$second\_deriv := \frac{288}{(6\,t+3)^3} \qquad (10)$$

11

```
> f_11 := proc(t);(6*t - 9)/ (t+9) ; end proc;`f_11(t) `:=f_11(t);
  first_deriv:= diff(f_11(t),t);
  answer_11:=eval(%, t = 54);
```

$$f\_11 := \mathbf{proc}(t)\ (6 * t-9)\,/\,(t+9)\ \mathbf{end\ proc}$$

$$f\_11(t) := \frac{6\,t-9}{t+9}$$

$$first\_deriv := \frac{6}{t+9} - \frac{6\,t-9}{(t+9)^2}$$

$$answer\_11 := \frac{1}{63} \qquad (11)$$

12. Relatively messy WRONG ANSWER

```
> Demand:= proc(p);31500/p  ; end proc:`Demand(p) `:= Demand(p);
  price:= proc(t); t^(2/3) + 5.15; end proc:`price(t) `:=price(t);
  demand:= proc(t);Demand(price(t))  ; end proc:`demand as a fn ot t
  `:=demand(t);
     deriv:= diff(demand(t),t);
  answer_12:=eval(%,t=27.);
```

$$Demand(p) := \frac{31500}{p}$$

$$price(t) := t^{2/3} + 5.15$$

$$demand\ as\ a\ fn\ ot\ t := \frac{31500}{t^{2/3} + 5.15}$$

$$deriv := -\frac{21000}{\left(t^{2/3} + 5.15\right)^2 t^{1/3}}$$

$$answer\_12 := -34.96110576 \quad (12)$$

13.

```
> y_13:= proc(x); (7*x^2 + x - 1)^3 ; end proc:`y_13(x) `:= y_13(x);
  ddxy_13:= proc(x);diff(y_13(x),x)  ; end proc:deriv:= ddxy_13(x);
  slope_at_0:= eval(ddxy_13(x),x= 0);
  answer_13:= y_13(0) + slope_at_0 * x;
```

$$y\_13(x) := \left(7x^2 + x - 1\right)^3$$

$$deriv := 3\left(7x^2 + x - 1\right)^2 (14x + 1)$$

$$slope\_at\_0 := 3$$

$$answer\_13 := -1 + 3x \quad (13)$$

14 IMPLICIT DIFFERENTIATION. At a constant level of productio at x = 60, y = 150.

```
> Q:= proc(x,y); 0.06*x^2 + 0.15 * x * y + 0.05* y^2 ; end proc:
  `Q(x,y) `:=Q(x,y);
  `Q0 `:=Q(60,150);
  eqn:= Q0 = 0.06*x^2 + 0.15 * x * y + 0.05* y^2;
  dy_dx:= proc(x,y);
     implicitdiff(eqn ,y, x);
  end proc;
  `dydx `:=dy_dx(x,y);answer_14:=eval(%,{x=60,y=150});
  #implicitplot(eqn, x =50 .. 70, y= 140 .. 160, thickness =4):
```

$$Q(x,y) := 0.06\,x^2 + 0.15\,x\,y + 0.05\,y^2$$

$$Q0 := 2691.00$$

$$eqn := Q0 = 0.06\,x^2 + 0.15\,x\,y + 0.05\,y^2$$

$$dy\_dx := \mathbf{proc}(x, y)\ implicitdiff(eqn, y, x)\ \mathbf{end\ proc}$$

$$dydx := -\frac{0.6000000000\ (4.\ x + 5.\ y)}{3.\ x + 2.\ y}$$

$$answer\_14 := -1.237500000 \quad (14)$$

15. f

```
> f_15:= proc(x); x^3 - 12*x -5 : end proc:`f_15(x) `:=f_15(x);
  deriv:= proc(x);diff(f_15(x),x)  ; end proc:`deriv `:=deriv(x);
  answer_15:= solve(deriv(x) = 0,x);
```

$$f\_15(x) := x^3 - 12\,x - 5$$

$$deriv := 3\,x^2 - 12$$

$$answer\_15 := 2, -2 \quad (15)$$

16.

```
> f_16:= proc(x); x^2 + 5*x -3 ; end proc:`f_16(x) `:=f_16(x);
  deriv:= proc(x); diff(f_16(x),x) ; end proc:`deriv `:=deriv(x);
  INC:= solve(deriv(x)> 0,x);
  DEC:= solve(deriv(x) < 0, x);
```

$$f\_16(x) := x^2 + 5\,x - 3$$

$$deriv := 2\,x + 5$$

$$INC := RealRange\left(Open\left(-\frac{5}{2}\right),\ \infty\right)$$

$$DEC := RealRange\left(-\infty,\ Open\left(-\frac{5}{2}\right)\right) \quad (16)$$