Math 1P97. Assignment 2 (4%). **Due date: Friday, May 26, 6:45 pm**

Student's name: _____

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Total mark: _____

NOTE: Students are expected to complete all questions on the assignment. However, only a subset of questions will be considered for marking. Marks will be deducted for incomplete assignments.

1. (Maple Question) Use Maple to plot a piecewise function and compute the limits. Consider the function

$$g(x) = \begin{cases} x+1 & \text{if } x \leqslant -1 \\ x^2 & \text{if } -1 < x \leqslant 2 \\ -x+4 & \text{if } x > 2 \end{cases}$$

Start a new Maple worksheet and press the [> button to start a new line.

Switch from presentation font (*black italic*) to Maple input font (red bold) *On PC: press F5, or on Mac: press Fn-F5, the font should be red, bold and not italic. You can also highlight the black font, 'Right Click'-'Convert To'-'1-D Math Input' to convert to the red font.*

Start with your information as a comment, restart Maple and load the plot package

```
[> #Q1.  <name> <student number>
[> restart:with(plots):
```

Enter the function and plot it on Maple using the command

```
[> g:=x->piecewise(x<=-1,x+1,-1<x and x<=2,x^2,x>2,-x+4);
```

Note: Type the command for the hat symbol with 'Ctrl-6' on the keyboard.

Now plot the function with the command

```
[> plot(g(x),x=-4..4,discont=true);
```

Evaluate $g(-1)$, $\lim_{x\to -1} g(x)$, and the left and right limit as x approaches:

```
[> g(-1);
[> limit(g(x),x=-1);
[> limit(g(x),x=-1,left);
[> limit(g(x),x=-1,right);
```

Repeat these commands for the case $x = 2$. Use your worksheet to answer a) and b).

a) For each case $x = -1$ and $x = 2$, explain why the limit does or does not exist.

b) The points $x = -1$ and $x = 2$ are discontinuities. Refer to the definition on the top of page 124 of the textbook and explain why these points are discontinuities.

2. Text Question 32 on page 169. State the domain of the function and the domain of the derivative.

3. Find the derivative of the function $f(x) = \dfrac{1}{x}$ using only the definition of the derivative. State the domain of the function and the domain of the derivative.

4. Text Question 46 on page 170.

5. Read Text Question 60 page 171. This question will be done on Maple.

```
[> #Q4.  <name> <student number>
[> restart:with(plots):
[> P:=0.257*t^2+0.57*t+3.9;
```

To find the percentage in 2008, this corresponds to $t = 2$, and we subsitute $t = 2$ into the function with

```
[> subs(t=2,P);
```

The rate of the percentage changing is the derivative, which we can find with

```
[> diff(P,t);
```

Use the derivative to find the rate in 2008. Print out your worksheet, label the parts of the question and circle the answers. Include a written conclusion on your printout by starting a new line and press 'Ctrl-T'.

6. Find the derivative of $f(x) = (x + 2)(x^2 - 3x + 1)$.

7. Find the derivative of $f(x) = \dfrac{x + 1}{x^2 + 3}$.

8. Read Question 60 page 183. Answer this question using only Maple, the code you need is similar to the above. Any work by hand will not be marked. Print out your worksheet, label the parts of the question and circle the answers. Note that there are 3 questions to be answered.
9. Text Question 38 page 182.

10. Find the derivative of $f(x) = \left(\frac{x-1}{x+1}\right)^2$. Show your work and simplify. Use Maple to verify your answer. Do not submit printout. You might need the `simplify(%);` command which simplifies the given input and the percent sign means the previous result, i.e. simplify the previous answer.

11. Find the derivative of $f(x) = 2(x^3 + x^2 + 2)^3$.

12. Text Question 32 page 194.

13. Text Question 10 page 210.

14. For the equation $x^2 + y^2 + y = 4$, find y' by implicit differentiation.

15. (Maple Question) Use Maple to solve Text Question 34 page 231.

```
[> #15.  <name> <student number>
[> restart:with(plots):
```

Define the equation

```
[> eqn:=(x-y-1)^3=x;
```

Use implicit differentiation to find y':

```
[> yp:=implicitdiff(eqn,y,x);
```

Plot implicitly and save the plot (no output will be produced if you use a colon):

```
[> plot1:=implicitplot(eqn,x=-5..5,y=-5..5,color=black,linestyle=1):
```

Define the slope at the point $(1, -1)$

```
[> m:=subs([x=1,y=-1],yp);
```

Define the tangent line with

```
[> line:=m*(x-1)-1;
```

Save the plot with

```
[> plot2:=plot(line,x=-5..5,color=black,linestyle=2):
```

Now plot both graphs together with

```
[> display(plot1,plot2);
```

Notice how inaccurate the curve has been plotted, increase the accuracy with the `numpoints` command. Redo the first plot with:

```
[> plot1:=implicitplot(eqn,x=-5..5,y=-5..5,color=black,linestyle=1,numpoints=10000):
[> display(plot1,plot2);
```

Print out your graphs and label the point where the tangent touches the curve.