Assignment 18: Integration Techniques (6.1-6) **Name____________________**
Please provide a handwritten response.

1a. The text notes that using identities we can often show that two different–looking results for an integral are both correct. Evaluate $\int \cos^3 x \sin^2 x \, dx$ by hand and record the result below.

1b. Evaluate this integral in *Maple* by executing

```
int(cos(x)^3*sin(x)^2,x);
```

and record the result below. Does it look the same as your answer in part **a**?

1c. The `simplify(trig)` command applies identities to change the form of trigonometric expressions; execute

```
simplify((1/3)*sin(x)^3-(1/5)*sin(x)^5);
```

to transform your result in part **a** and record the result below. Was *Maple*'s result correct after all?

2a. Multiplication in some CAS can be denoted by a space, however *Maple* must use the multiplication operator `*`. To find $\int x \sin x \, dx$ execute both

```
int(x*sin(x),x);
```

and then with a space between x and sin *x*.

```
int(x sin(x),x);
```

and record the result below; was there any difference between the two?

2b. Now repeat the last command without the space between `x` and `sin(x)`, and record the result below. What does this result mean?

3a. The inverse tangent function is denoted in *Maple* by `arctan`; execute

```
int(exp(x)*arctan(exp(x)),x);
```

to evaluate the integral $\int e^x \tan^{-1} e^x dx$ and record the result below.

3b. The `%` symbol (found above the "5" on your keyboard) refers in *Maple* to the immediately preceding output, and is useful provided you don't lose track of what the last output was! (Remember: Versions earlier than Release 5.0 use `"`.) Execute **`%;`** and compare it to your answer in part **a**.

3c. We can differentiate *Maple*'s result in part **a** using the **`diff`** command introduced earlier; execute **`diff(%,x);`** and record the result below. Was *Maple*'s integral correct?

4a. To investigate *Maple*'s ability to evaluate $\int x^3 e^{5x} \cos 3x \, dx$; execute

```
int(x^3*exp(5*x)*cos(3*x),x);
```

and record below just the denominator of the leading fraction in *Maple*'s result.

4b. Now check your result by executing **`diff(%,x);`** as in Question **2c**. Is your answer surprising? Do you think that *Maple* has made a mistake somewhere?

4c. Bearing in mind that `%` now refers to the output you just obtained, execute **`simplify(%);`** and record the result below. What lesson should we learn here?

5a. The **`convert(parfrac)`** command performs partial fraction decompositions. Convert $\dfrac{x^2+2x-1}{(x-1)^2(x^2+4)}$ to partial fractions by executing

```
convert((x^2+2*x-1)/((x-1)^2*(x^2+4)),parfrac,x);
```

and recording the result below. Check your result by executing **`normal(%);`** does everything look correct?

5b. Use the **`int`** command to find an antiderivative of the expression in part **a**, and record the result below.

5c. Now proceed according to Question **4b**, **c** to check *Maple*'s result. Does it appear to be correct at first? At last?

6. Go through the three steps in Question **4** for $\displaystyle\int \frac{\cos(x)}{\sin^2(x)(3+2\sin(x))}\,dx$. Are you able to confirm that *Maple*'s antiderivative is correct? Explain.