Name: Answer Key **Math 1030 Quiz #5** (August 1st, 2016)

You may **skip ONE** of the following problems.

1. We have the following supply and demand functions:

$$p_s(x) = 0.1x^3 \qquad \text{and} \qquad p_d(x) = 1000e^{-x/10}$$

```
0.1x^3 = 1000e^(-x/10) ✓
```

Gives us that $x \approx 13.663$ (this is our equilibrium quantity). If we plug this quantity into the demand or supply function, we'll get our equilibrium price (both supply and demand should yield the same price since this is where the functions intersect).

```
0.1x^3 at x=13.663 ✓
```

Market equilibrium $(q_E, p_E) =$ (13.663, 255.06)

To find the consumer and producer surpluses we just use our formulas.

```
(int 1000e^(-x/10) from 0 to 13.663) - 13.663(255.06) ✓
```

The consumer surplus is \$ $\int_0^{q_E} p_d(x)\,dx - q_E \cdot p_E = 3964.63$

```
13.663(255.06) - (int 0.1x^3 from 0 to 13.663) ✓
```

The producer surplus is \$ $q_E \cdot p_E - \int_0^{q_E} p_s(x)\,dx = 2613.67$

2. Pseudogreenland has determined that their Lorentz curve is given by $L(x) = 0.65x^4 + 0.3x^3 + 0.05x$.

```
0.65x^4+0.3x^3+0.05x at x=0.30 ✓
```

The poorest 30% percent of the population hold $0.028365 \approx 2.837\%$ of the wealth.

```
0.65x^4+0.3x^3+0.05x = 0.30 ✓
```

The poorest $0.70433 \approx 70.433\%$ percent of the population hold 30% of the wealth.

```
1 - 2(int 0.65x^4+0.3x^3+0.05x from 0 to 1) ✓
```

Pseudogreenland's Gini Index is $1 - 2\int_0^1 L(x)\,dx = 0.54$.

3. We know that $P'(q) = 1150 - 54q + 0.75q^2 - 0.0032q^3$ for some profit function $P(q)$. In addition, we also know that $q = 20$ is a break even quantity for $P(q)$.

```
int 1150-54 q+0.75 q^2-0.0032 q^3 ✓
```

This tells us that $P(q) = -0.0008q^4 + 0.25q^3 - 27q^2 + 1150q + C$ for some constant C. But we have been told that $P(20) = 0$ (i.e. $P(q)$ has a break even point at $q = 20$). Using our formula, we get that

```
1150 q-27 q^2+0.25 q^3-0.0008 q^4+C at q=20 ✓
```

$P(20) = C + 14072$. So to make $P(20) = 0$ we need to set $C = -14072$.

$P(q) =$ $-0.0008q^4 + 0.25q^3 - 27q^2 + 1150q - 14072$