MAT127 **Supplementary Notes**

Chapter 5.4 + 5.5 Net Change Theorem, Substitution

Net Change Theorem: The integral of a rate of change is the net change: let $s(t)$ be position and $s'(t) = v(t)$ be velocity. Then

The *displacement* of an object is the net change of position:

The *distance traveled* is the total amount of distance moved:

Example 1. *A particle moves along a line so that its velocity at time t is $v(t) = t^2 - t - 6$. Find the displacement and distance traveled from $1 \leq t \leq 4$.*

Substitution: indefinite integrals

We learn to solve new antiderivatives using **substitution** or **u-substitution**.

Example 2. *Compute*

$$\int 2x\sqrt{1+x^2}dx.$$

Take-away:

Example 3.

$$\int x^3\cos(x^4+2)dx.$$

Definite integrals

Example 4. *Solve*

$$\int_0^4 \sqrt{2x+1}dx.$$

Example 5. *Solve*

$$\int_1^e \frac{\ln x}{x}dx.$$

Example 6.

$$\int \sqrt{1+x^2}x^5 dx.$$

Boot Camp

Example 7. *Solve the following integrals:*

Appetizers:

$$\int (3t-1)^{50} dt$$

$$\int_0^3 \frac{dx}{5x+1}$$

Entrees:

$$\int_0^{\pi/2} \cos x \sin(\sin(x))dx$$

$$\int \tan x dx$$

Desserts:

$$\int \frac{x^9}{1+x^{20}}dx$$

$$\int_0^1 \frac{dx}{(1+\sqrt{x})^4}$$

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