Close Today: HW_5A, 5B (7.1,7.2)
Close Mon: HW_5C   (7.3)
Close Wed: HW_6A   (7.4)
Close next Fri: HW_6B, 6C (7.5, 7.7)
Office Hours today: 1:30-3:30pm, Com B-006

Entry Tasks: Fill in the blanks

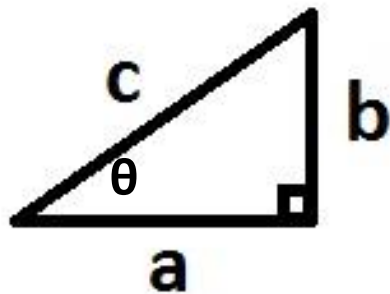| Square Identities |
|---|
| $\sin^2(x) =$ |
| $\cos^2(x) =$ |
| $\sec^2(x) =$ |
| $\tan^2(x) =$ |
| **Half Angle Identities** |
| $\sin^2(x) =$ |
| $\cos^2(x) =$ |
| $\sin(x)\cos(x) =$ |

What are these in terms of a, b, c?

$\sin(\theta) =$

$\cos(\theta) =$

$\tan(\theta) =$

$\sec(\theta) =$

What is the first step in each below?

$$\int \sin^3(x)\cos^4(x)\,dx$$

$$\int \sin^5(x)\cos^3(x)\,dx$$

$$\int \cos^4(x)\,dx$$

$$\int \tan^5(x)\sec^4(x)\,dx$$

$$\int \tan^5(x)\sec(x)\,dx$$

7.3 Trigonometric Substitution

Goal: Evaluation method for integrals with $\sqrt{a^2 - x^2}$, $\sqrt{a^2 + x^2}$, or $\sqrt{x^2 - a^2}$

3 Types of Problems/Motivation

1. $a^2 - x^2$, *example*:

$$\int \frac{x^3}{\sqrt{4 - x^2}} dx$$

2. $a^2 + x^2$, *example*:

$$\int x^2 \sqrt{9 + x^2} dx$$

3. $x^2 - a^2$, *example*:

$$\int \frac{\sqrt{x^2 - 16}}{x} dx$$

CASE	SUBSTITUTION
$a^2 - x^2$	$x = a\sin(\theta), \quad -\pi/2 \le \theta \le \pi/2$
$a^2 + x^2$	$x = a\tan(\theta), \quad -\pi/2 < \theta < \pi/2$
$x^2 - a^2$	$x = a\sec(\theta), \quad 0 \le \theta < \pi/2,$ (positive x) $\quad\quad\quad\quad\quad\quad \pi \le \theta < 3\pi/2$ (negative x)

Trigonometric Substitution Method:
  A) Make the substitution.
     Don't forget dx = ??? dθ.
     Use trig identity (eliminate root)
  B) Use 7.2 methods.
  C) Draw a triangle and return to x.

Completing the Square:

$$\sqrt{ax^2 + bx + c}$$

If you ever encounter a "**middle term**" (like **bx** above), then you need to complete the square.

Example: $\sqrt{64 - 24x - 4x^2}$

i) **Factor out the "a".**

$$\sqrt{4(16 - 6x - x^2)} = 2\sqrt{16 - 6x - x^2}$$

ii) **Add and subtract "half the middle squared"**

Half of middle = (-6)/2   = -3
Squared   = (-3)^2 = 9

$$2\sqrt{16 + 9 - 9 - 6x - x^2}$$

iii) **Factor the perfect square**

$$2\sqrt{25 - (x + 3)^2}$$

iv) **Check your work!.**