Final Exam Information and Study Guide
Math 112 (INTO)

Information

• The test is on (Thursday) December 10th at 12:00 pm in Kidder Hall, room 236.
• The test will last for exactly one hour - fifty minutes and thus will end at 9:50.
• A sheet of identities and formulas will be attached to the exam. This sheet is attached to the end of this review sheet and is available on the study guide section of the MTH 112 homepage. Note that this sheet does not contain anything about vectors, parametric equations or polar equations.
• You may use both a $3 \times 5$ note card with anything you want on it and a calculator (no restriction on type). The note card may be hand written or typed.
• You will need to present photo ID to the proctors when turning in your exam.
• The exam is cumulative and so contains the information that was covered before and after the midterm exam. This would be chapters 6, 7 and 8 (not section 8.6) from the text. The test will be (roughly) half focused on the material leading up to the midterm exam and half focused on material after the midterm exam.
Study Guide

As general preparation you should:

- Review the midterm exam.
- Review your homework. (This can be done by going to the gradebook portion of CourseCompass.com)
- Review your notes and the examples that we have done in class.
- Review the problems from the quizzes.

Suggested Problems:
*These problems should not be taken as a “promise” or “guarantee” of what will (or will not) be on the final exam. They are suggestions of the types of problems that you should be familiar and comfortable with. It is a good idea to try to think through what types of related or similar problems could be asked as you work through these problems.

- Chapter 6 Review (pages 569 - 572): 1, 2, 3, 4, 5, 6, 13, 16, 19, 21, 27, 31, 35, 37, 41, 49, 51 (these are the problems that were given on the midterm study guide).
- Chapter 7 Review (pages 642 - 644): 1, 5, 6, 13, 19, 31, 33, 39, 45, 47, 52, 55, 57, 61, 63, 65
- Chapter 8 Review (pages 722 - 724): 1, 3, 6, 8, 11, 13, 15, 16, 17, 19, 24, 15, 28, 29, 43, 45, 46
- There are extra practice problems included as part of Activity 10.
Trigonometry Identities
MTH 112 - Oregon State University

Reciprocal Identities
\[
\begin{align*}
csc \theta &= \frac{1}{\sin \theta} & \sin \theta &= \frac{1}{\csc \theta} \\
sec \theta &= \frac{1}{\cos \theta} & \cos \theta &= \frac{1}{\sec \theta} \\
cot \theta &= \frac{1}{\tan \theta} & \tan \theta &= \frac{1}{\cot \theta}
\end{align*}
\]

Quotient Identities
\[
\begin{align*}
tan \theta &= \frac{\sin \theta}{\cos \theta} & \cot \theta &= \frac{\cos \theta}{\sin \theta}
\end{align*}
\]

Pythagorean Identities
\[
\begin{align*}
\sin^2 \theta + \cos^2 \theta &= 1 & tan^2 \theta + 1 &= \sec^2 \theta & \cot^2 \theta + 1 &= \csc^2 \theta
\end{align*}
\]

Negative Angle Identities
\[
\begin{align*}
\sin(-\theta) &= -\sin \theta & \csc(-\theta) &= -\csc \theta \\
\cos(-\theta) &= \cos \theta & \sec(-\theta) &= \sec \theta \\
\tan(-\theta) &= -\tan \theta & \cot(-\theta) &= -\cot \theta
\end{align*}
\]

Sum/Difference Identities
\[
\begin{align*}
cos(\alpha + \beta) &= \cos \alpha \cos \beta - \sin \alpha \sin \beta & \cos(\alpha - \beta) &= \cos \alpha \cos \beta + \sin \alpha \sin \beta \\
\sin(\alpha + \beta) &= \sin \alpha \cos \beta + \cos \alpha \sin \beta & \sin(\alpha - \beta) &= \sin \alpha \cos \beta - \cos \alpha \sin \beta \\
\tan(\alpha + \beta) &= \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} & \tan(\alpha - \beta) &= \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \tan \beta}
\end{align*}
\]

Cofunction Identities
\[
\begin{align*}
\sin(\frac{\pi}{2} - \theta) &= \cos \theta & \cos(\frac{\pi}{2} - \theta) &= \sin \theta \\
\sec(\frac{\pi}{2} - \theta) &= \csc \theta & \csc(\frac{\pi}{2} - \theta) &= \sec \theta \\
\tan(\frac{\pi}{2} - \theta) &= \cot \theta & \cot(\frac{\pi}{2} - \theta) &= \tan \theta
\end{align*}
\]

Double Angle Formulas
\[
\begin{align*}
\sin(2\theta) &= 2\sin \theta \cos \theta \\
\cos(2\theta) &= \cos^2 \theta - \sin^2 \theta = 2\cos^2 \theta - 1 = 1 - 2\sin^2 \theta \\
\tan(2\theta) &= \frac{2\tan \theta}{1 - \tan^2 \theta}
\end{align*}
\]

Power-Reducing Identities
\[
\begin{align*}
\sin^2 \theta &= \frac{1 - \cos(2\theta)}{2} & \cos^2 \theta &= \frac{1 + \cos(2\theta)}{2} & \tan^2 \theta &= \frac{1 - \cos(2\theta)}{1 + \cos(2\theta)}
\end{align*}
\]
Half Angle Formulas

\[ \sin \left( \frac{\theta}{2} \right) = \pm \sqrt{\frac{1 - \cos \theta}{2}} \quad \cos \left( \frac{\theta}{2} \right) = \pm \sqrt{\frac{1 + \cos \theta}{2}} \]

\[ \tan \left( \frac{\theta}{2} \right) = \pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} \quad \tan \left( \frac{\theta}{2} \right) = \frac{1 - \cos \theta}{\sin \theta} \quad \tan \left( \frac{\theta}{2} \right) = \frac{\sin \theta}{1 + \cos \theta} \]

Where the sign \( +/− \) is determined by the quadrant containing \( \frac{\theta}{2} \).

Product to Sum and Sum to Product Identities

\[ \cos \alpha \cos \beta = \frac{1}{2} [\cos (\alpha + \beta) + \cos (\alpha - \beta)] \quad \sin \alpha \cos \beta = \frac{1}{2} [\sin (\alpha + \beta) + \sin (\alpha - \beta)] \]

\[ \sin \alpha \sin \beta = \frac{1}{2} [\cos (\alpha - \beta) - \cos (\alpha + \beta)] \quad \cos \alpha \sin \beta = \frac{1}{2} [\sin (\alpha + \beta) - \sin (\alpha - \beta)] \]

\[ \cos \alpha + \cos \beta = 2 \cos \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2} \quad \cos \alpha - \cos \beta = -2 \sin \frac{\alpha + \beta}{2} \sin \frac{\alpha - \beta}{2} \]

\[ \sin \alpha + \sin \beta = 2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2} \quad \sin \alpha - \sin \beta = 2 \cos \frac{\alpha + \beta}{2} \sin \frac{\alpha - \beta}{2} \]

The Law of Sines.

Any triangle with standard labeling satisfies the following equalities:

\[ \frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c} \quad \text{and} \quad \frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma} \]

The Law of Cosines.

Any triangle with standard labeling satisfies the following equalities:

\[ a^2 = b^2 + c^2 - 2bc \cos \alpha \]
\[ b^2 = a^2 + c^2 - 2ac \cos \beta \]
\[ c^2 = a^2 + b^2 - 2ab \cos \gamma \]

Area Formulas

\[ K = \frac{1}{2} ab \sin \gamma \]
\[ K = \frac{1}{2} ac \sin \beta \]
\[ K = \frac{1}{2} bc \sin \alpha \]

Useful Formulas

\[ \omega = \frac{\theta}{t} \]
\[ v = \omega r \]
\[ s = r \theta \]
\[ A = \frac{1}{2} r^2 \theta \]