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PLANE TRIGONOMETRY

Exam I
September 13, 2007

Page 1 (10 pts.)	**Page 2** (30 pts.)	**Page 3** (30 pts.)	**Page 4** (30 pts.)	**TOTAL** (100 pts.)

Below you will find 10 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed. **Sign and submit your formula sheet with the exam.**

Problem 1. Convert the units as indicated:

(a) $12.35°$ to degrees, minutes and seconds.

(b) $\dfrac{7\pi}{72}$ (radians) to degrees, minutes and seconds.

Problem 2. Find two positive coterminal angles and one negative coterminal angle for each of the following angles:

(a) -230° (use degrees);

(b) $\dfrac{9\pi}{11}$ (use radians).

Problem 3. An angle θ, in standard position, is located in the third quadrant and has $\cot\theta = \dfrac{20}{21}$. Find the **exact** values of $\sin\theta$ and $\cos\theta$.

Problem 4. Find the **exact** values of $\sin\left(-\dfrac{5\pi}{4}\right)$ and $\cos\left(-\dfrac{5\pi}{4}\right)$.

Problem 5. Find the length of the the arc that subtends the angle 100° on a circle of diameter 18 in.

Problem 6. Prove the identity: $\sin^2 t(\csc^2 t - 1) = \cos^2 t$.

Problem 7. Find the **exact** values of t, in the interval $[-\pi, 5\pi]$, which satisfy the equation

$$\sin t = -\frac{\sqrt{2}}{2}.$$

Problem 8. Find the equation of the line that passes through the points $A(-2, 2)$ and $B(3, -8)$.

Problem 9. Find the equation of the line that passes through the point $P(2, -1)$ and is parallel to the line $3x - 4y = 7$.

Problem 10. Find the equation of the line that passes through the point $Q(-1, 2)$ and is perpendicular to the line $x - 4y = 12$.

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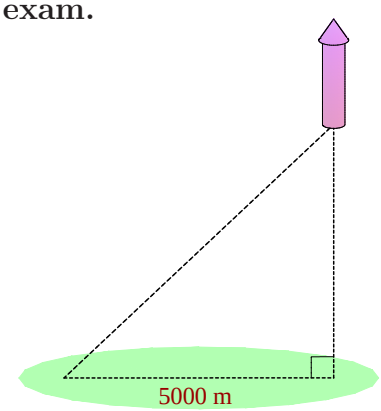
PLANE TRIGONOMETRY

Exam II
October 11, 2007

Page 1 (10 pts.)	**Page 2** (30 pts.)	**Page 3** (30 pts.)	**Page 4** (30 pts.)	**TOTAL** (100 pts.)

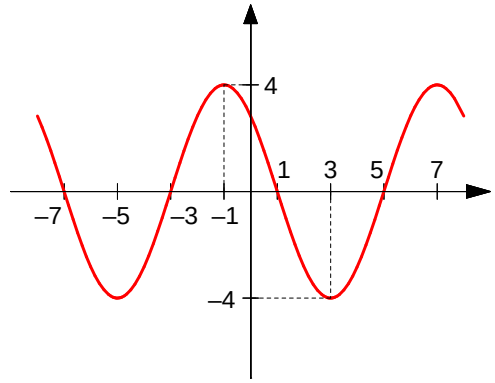
Below you will find 10 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed. **Sign and submit your formula sheet with the exam.**

Problem 1. A rocket, flying on a straight vertical trajectory, is observed from a point positioned 5000 meters away from the launch site. During the final minute of flight, the angle of elevation of the rocket (measured from the observation point) changed from 32° to 61°. How long was the flight path of the rocket during this period? Approximate your answer to the nearest tenth of a meter.



Problem 2. The graph of the equation $y = a\sin(bx + c)$, with $a > 0$ and $b > 0$, is shown in the figure below.

(a) Find the amplitude and the period.



(b) Find the coefficients a, b and c.

Problem 3. Find the amplitude, period, and phase shift for the curve $y = 3\sin\left(4x + \frac{\pi}{3}\right)$.

Problem 4. An angle θ, in standard position, has its terminal side in Quadrant IV on the line $12x + 5y = 0$. Find the **exact** values of $\sin\theta$ and $\cos\theta$.

Problem 5. Find **all** solutions of the equation: $\sin\left(4x - \frac{\pi}{3}\right) = 1$. Use **exact** values.

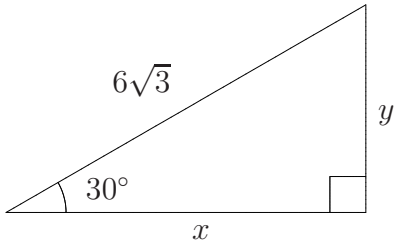
Problem 6. Find **exact** values of $\sin(-600°)$ and $\cos(-600°)$, using the following procedure: (1) find the quadrant; (2) find the reference angle θ_R; (3) use previous steps and the reference angle formulas $\sin\theta = \pm\sin\theta_R$ and $\cos\theta = \pm\cos\theta_R$.

Problem 7. Find the solutions of the equation $4\cos^2 t + 4\cos t - 3 = 0$, that are in the interval $[0, 2\pi)$. Use **exact** values

Problem 8. Verify the indentity: $\sin x + \cos x \cot x = \csc x$.

Problem 9. Given the right triangle $\triangle ABC$, with $\gamma = 90°$, $a = 3$ cm, and $b = 7$ cm, find the remaining elements of the triangle: the side c, and the angles α and β. (When computing the angles, express them in degrees, rounded to the nearest tenth.)

Problem 9. Find the sides labeled x and y in the right triangle:



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PLANE TRIGONOMETRY

Exam III
November 8, 2007

Page 1 (10 pts.)	**Page 2** (30 pts.)	**Page 3** (30 pts.)	**Page 4** (30 pts.)	**TOTAL** (100 pts.)

Below you will find 10 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed. **Sign and submit your formula sheet with the exam.**

Problem 1. The triangle $\triangle ABC$ has $a = 5$ cm, $b = 6$ cm, and $\widehat{A} = 30°$. Find the remaining parts: $\widehat{B}$, $\widehat{C}$, and c. (Express all angles in degrees. Round to two decimal places.)
Warning: This problem has two solutions!

Problem 2. The triangle $\triangle ABC$ has $a = 10$ cm, $\widehat{B} = 45°$, and $\widehat{C} = 60°$. Find the remaining parts: $\widehat{A}$, b, and c. (Express all angles in degrees. Round to two decimal places.)

Problem 3. The triangle $\triangle ABC$ has $a = 15$ cm, $b = 4$ cm and $\widehat{C} = 60°$. Find the remaining parts: $\widehat{A}$, $\widehat{B}$, and c. (Express all angles in degrees. Round to two decimal places.)

Problem 4. Find the **exact** value of $\cot\left[\arcsin\left(-\frac{1}{3}\right)\right]$.

Problem 5. Given α and β in Quadrant III, with $\tan\alpha = \dfrac{4}{3}$ and $\cos\beta = -\dfrac{12}{13}$, find the **exact** values of $\tan(\alpha+\beta)$ and $\tan(\alpha-\beta)$.

Problem 6. Given θ in Quadrant II, with $\sin\theta = \dfrac{8}{17}$, find the **exact** values of $\sin(2\theta)$ and $\cos(2\theta)$.

Problem 7. Suppose $180^\circ \leq \theta \leq 360^\circ$, and $\cos\theta = -\dfrac{119}{169}$. Find the **exact** values of $\sin(\theta/2)$ and $\cos(\theta/2)$.

Problem 8. The triangle $\triangle ABC$ has $a = 5$ cm, $b = 6$ cm, and $c = 7$ cm. Find the remaining parts: $\widehat{A}$, $\widehat{B}$, and $\widehat{C}$. (Express all angles in degrees. Round to two decimal places.)

Problem 9. Verify the identity: $\dfrac{\sin(4\theta) + \sin(6\theta)}{\cos(4\theta) - \cos(6\theta)} = \cot\theta$.

Problem 10. Find all solutions of the equation $6\cos^2 t + 5\cos t - 6 = 0$, that are in the interval $[0, 2\pi)$. (Use radians and round to two decimal places.)

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PLANE TRIGONOMETRY

Final Exam
December 14, 2007

Page 1 (20 pts.)	**Page 2** (30 pts.)	**Page 3** (30 pts.)	**Page 4** (30 pts.)	**Page 5** (30 pts.)	**Page 6** (30 pts.)	**Page 7** (30 pts.)	**TOTAL** (200 pts.)

Below you will find 20 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed. **Sign and submit your formula sheet with the exam.**

Problem 1. Let u be an angle in quadrant II, with $\tan u = -\dfrac{12}{5}$. Find the **exact** values of $\sin u$ and $\cos u$.

Problem 2. Verify the identity: $\dfrac{\cot^2 x}{\csc x + 1} = \dfrac{1 - \sin x}{\sin x}$.

Problem 3. Let θ be an angle (in standard position) in quadrant IV, whose terminal side is parallel to the line $3x + 4y = 12$. Find the **exact** values of $\sin\theta$ and $\cos\theta$.

Problem 4. Let α and β be two angles in quadrant II, with $\sec\alpha = -\dfrac{5}{4}$ and $\sin\beta = \dfrac{15}{17}$. Find the **exact** values of $\sin(\alpha + \beta)$ and $\cos(\alpha + \beta)$.

Problem 5. Find all solutions of the equation $2\cos^2 x - 7\cos x + 3 = 0$, that are in the interval $[0, 2\pi]$. Use **exact** values.

Problem 6. Given $180° \leq \theta \leq 360°$, with $\cos\theta = -\dfrac{7}{25}$. Find the **exact** values of $\sin(\theta/2)$ and $\cos(\theta/2)$.

Problem 7. Find **all** solutions of the equation: $\sin 5t - \sin t = 0$. Use **exact** values.

Problem 8. Solve $\triangle ABC$, given: $a = 5$, $b = 6$, $\hat{A} = 30°$. (Express all angles in degrees. Round to two decimal places.)

Problem 9. Solve $\triangle ABC$, given: $a = 7$, $b = 2$, $\hat{C} = 60°$. (Express all angles in degrees. Round to two decimal places.)

Problem 10. Solve $\triangle ABC$, given: $a = 5$, $b = 7$, $c = 9$. (Express all angles in degrees. Round to two decimal places.)

Problem 11. Express the complex number $z = 2 - 2i$ in trigonometric form:

$$z = r(\cos\theta + i\sin\theta) \text{ (or } z = \operatorname{cis}\theta),$$

with $0 \leq \theta < 2\pi$.

Problem 12. Find the equation of the line that passes through the point $P(-1, 2)$, and is perpendicular to the line $x + 5y = 10$.

Problem 13. Find the vertex, focus, and directrix, for the parabola $-8(x + 2) = (y - 5)^2$.

Problem 14. Find the equation of the parabola with vertex $V(1, 2)$ and focus $F(1, -2)$.

Problem 15. Find the center, vertices, and foci, for the ellipse:

$$16(x-2)^2 + 9y^2 = 144.$$

Problem 16. Find the equation of the ellipse with vertices $V(\pm 4, -1)$ and foci $F(\pm 2, -1)$

Problem 17. Find the center, vertices, and the asymptotes, for the hyperbola:

$$\frac{(y+1)^2}{4} - \frac{(x-3)^2}{9} = 1.$$

Problem 18. Find the equation of the hyperbola with vertices $V(-1, \pm 1)$ and foci $F(-1, \pm 5)$.

Problem 19. Find the polar equation that has same graph as $(x+2)^2 + (y-1)^2 = 5$. The polar equation should have the form: "$r =$ *expression in* θ."

Problem 20. Let $\mathcal{L}$ be a line, with polar equation $r = \dfrac{12}{2\cos\theta - 3\sin\theta}$.

(a) Find the equation of $\mathcal{L}$ in rectangular coordinates (x, y).

(b) Find the x-intercept and the y-intercept of $\mathcal{L}$.