Name:

Precalculus (Math 1045)
PRACTICE Final Exam

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This examination contains twenty problems which are worth 10 points each; your final score will be the total of your ten best problems. No calculators or other electronic devices are allowed.

Write all complex numbers in standard form $a + bi$.

Half Angle Formula: $\cos\left(\frac{\theta}{2}\right) = \sqrt{\frac{1+\cos\theta}{2}}$

Half Angle Formula: $\sin\left(\frac{\theta}{2}\right) = \sqrt{\frac{1-\cos\theta}{2}}$

Law of Sines: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos C$

Trigonometric Values: $\sin 30° = \frac{1}{2}$, $\sin 45° = \frac{\sqrt{2}}{2}$, $\sin 60° = \frac{\sqrt{3}}{2}$, $\sin 75° = \frac{\sqrt{6}+\sqrt{2}}{2}$

Standard Parabola: $4py = x^2$

Standard Ellipse: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Standard Hyperbola: $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Problem 1. Find all complex zeros of the polynomial function

$$f(x) = x^3 - 7x^2 - 3x + 21.$$

Problem 2. Find all complex zeros of the polynomial function

$$f(x) = 3x^3 - 4x^2 - 2x + 1.$$

Problem 3. Find the slant asymptote of the rational function

$$f(x) = \frac{x^2 + 3x - 10}{x - 4}.$$

Problem 4. Find all real solutions to the equation

$$5^{x^2 - x + 2} = 125.$$

Problem 5. Find all real solutions to the equation

$$2\ln(x+4) = \ln(x+6).$$

Problem 6. Find the domain of the function

$$f(x) = \frac{\sqrt{25-x^2}}{\ln(x-2)}.$$

Problem 7. Find $\cos 15^\circ$.

Problem 8. Find an algebraic expression for $\sec(\arctan(x^2))$.

Problem 9. Find all complex solutions to the equation $z^3 - 8 = 0$.

Problem 10. Find the width of the parabola $y = ax^2$ as a function of y and a.

Problem 11. Consider a triangle with angles A, B, C and corresponding opposite sides a, b, c. Suppose $A = 45°$, $B = 75°$, and $a = 1$. Find b.

Problem 12. Consider a triangle with angles A, B, C and corresponding opposite sides a, b, c. Suppose $a = 3$, $b = 5$, and $C = 30°$. Find c.

Problem 13. Find the slope of the line through the points $(-2, f(-2))$ and $(2, f(2))$, where

$$f(x) = x^3 - x^2 - 3x.$$

Problem 14. Suppose $\log_b 16807 = \log_3 243$. Find b.

Problem 15. Find the focus of the parabola whose equation is

$$4y = x^2 - 4x - 12.$$

Problem 16. Find the vertices of the hyperbola whose equation is

$$x^2 - 10x - y^2 + 2y - 12 = 0.$$

Problem 17. Let $A = [1, 9]$, $B = (3, 5)$, and $C = \{0, 2, 4, 6, 8\}$. Write $A \setminus (B \cup C)$ as the union of disjoint intervals.

Problem 18. Find the vertex of the quadratic function

$$f(x) = 3x^2 + 6x + 7.$$

Problem 19. Let $f(x) = ax^2 + bx + c$, where $f(-1) = 3$, $f(0) = 3$, and $f(1) = 5$. Find a, b, and c.

Problem 20. When model rocket is launched from the ground, its height in meters at time t seconds later is given by the function

$$f(t) = bt - 5t^2,$$

where b is the initial velocity in meters per second. Suppose the rocket reaches its maximum height after 5 seconds. Find its initial velocity.