

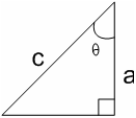
Final Exam – Version A

The square brackets following an exam question number refer to a section/problem number in the text. Problems numbers preceded by the symbol ~ are modeled on that problem from the text, but not identical to it. Problems numbers without the symbol are identical to or very close to the problem from the text.

INSTRUCTIONS FOR PART I: Write your answers for these questions on a scantron (form 882-E or 882-ES) and mark only one answer per question. Each of the questions in this part counts 4 points, for a total possible score of 80 points. You may use an approved calculator. You may write on this exam or request scratch paper if needed.

1. [3.5/~4] Given $f(x) = \frac{a(x+b)(x-c)}{(x-c)(x+d)}$ where $a, b, c, d > 0$, find an x -intercept and a vertical asymptote.
- A. $(-b, 0); x = c$ B. $(-b, 0); x = d$ C. $(-b, 0); x = -d$
 D. $(0, -b); x = -d$ E. $(0, 0); x = -b$

2. [5.1/~35] Find the area of a sector of a circle with diameter 12 cm that is determined by a central angle of 140° .
- A. $7\pi \text{ cm}^2$ B. $8\pi \text{ cm}^2$ C. $9\pi \text{ cm}^2$ D. $10\pi \text{ cm}^2$ E. $14\pi \text{ cm}^2$

3. [5.2/~9] Given the triangle , find $\csc \theta$ in terms of a and c .
- A. $\frac{a}{\sqrt{c^2 - a^2}}$ B. $\frac{c}{\sqrt{c^2 - a^2}}$ C. $\frac{\sqrt{c^2 - a^2}}{a^2}$ D. $\frac{\sqrt{c^2 - a^2}}{c}$ E. $\frac{c}{a}$

4. [5.2/~24] The peak of a mountain is approximately 10,800 feet high. A student, several miles away, notes that the angle between ground level and the peak is 38° . Estimate (to the nearest foot) the distance from the student to the point on ground level directly beneath the peak.
- A. 17,892 ft B. 16,876 ft C. 15,424 ft D. 13,823 ft E. 12, 856 ft

5. [5.2/~73] Find the exact value of $\sec \theta$ if θ is in standard position and the point $(-2, 7)$ is on the terminal side of the angle.
- A. $-\frac{\sqrt{53}}{2}$ B. $-\frac{\sqrt{53}}{7}$ C. $\frac{\sqrt{53}}{2}$ D. $-\frac{7}{\sqrt{53}}$ E. $-\frac{2}{\sqrt{53}}$

6. [5.7/~26] From a point 20 meters above level ground, a surveyor measures the angle of depression of an object on the ground at 52° . Approximate, to the nearest 0.1 meter, the distance from the object to the point on the ground directly beneath the surveyor.
 A. 25.5 meters B. 20.3 meters C. 17.4 meters D. 15.6 meters
 E. 14.7 meters
7. [6.2/~17] Find all solutions of the equation $\sin\left(2x - \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$.
 A. $\frac{\pi}{3} + \pi n, \frac{\pi}{2} + \pi n$ B. $\frac{\pi}{3} + 2\pi n, \frac{\pi}{2} + 2\pi n$ C. $\frac{\pi}{3} + 3\pi n, \frac{\pi}{2} + 3\pi n$
 D. $\frac{\pi}{3} + \frac{\pi}{2}n, \frac{\pi}{2} + \frac{\pi}{2}n$ E. $\frac{\pi}{3} + \frac{\pi}{4}n, \frac{\pi}{2} + \frac{\pi}{4}n$
8. [10.3/~31] Determine an equation of the hyperbola that satisfies the conditions: the center is at the origin, the foci are $(0, \pm 5)$, and the conjugate axis has length 4.
 A. $\frac{x^2}{21} - \frac{y^2}{4} = 1$ B. $\frac{y^2}{25} - \frac{x^2}{4} = 1$ C. $\frac{y^2}{25} - \frac{x^2}{2} = 1$ D. $\frac{y^2}{21} - \frac{x^2}{4} = 1$
 E. $\frac{x^2}{25} - \frac{y^2}{21} = 1$
9. [10.1/10] Determine the vertex V and the focus F of the parabola $y^2 - 4y - 2x - 4 = 0$.
 A. $V(-4, 2); F(-7, 2)$ B. $V(-4, 2); F\left(-\frac{7}{2}, 2\right)$ C. $V(-4, 2); F(7, -2)$
 D. $V(-4, 2); F\left(\frac{7}{2}, -2\right)$ E. $V(-4, 2); F\left(-\frac{7}{2}, -2\right)$
10. [10.3/~1-8] Find the foci of the ellipse $\frac{(y+4)^2}{13} + \frac{(x+4)^2}{2} = 1$.
 A. $(-4, -4 \pm \sqrt{6})$ B. $(-3, -3 \pm \sqrt{11})$ C. $(-4, -4 \pm \sqrt{11})$
 D. $(-4 \pm \sqrt{11}, -4)$ E. $(-4 \pm \sqrt{6}, -4)$
11. [3.2/~9] The polynomial $f(x)$ divided by $x - 3$ results in a quotient of $x^2 + 3x - c$, where c is a nonzero real number, and a remainder of 2. Find $f(3)$.
 A. -5 B. -2 C. 2 D. c E. $18 - c$

12. [10.1/~5] Find the directrix of the parabola $12(y+4) = (x-6)^2$.
 A. $y = -7$ B. $y = -1$ C. $y = 3$ D. $x = 6$ E. $x = -6$
13. [10.1/~45] A parabolic reflector has width 16 ft and depth 4 ft. How far from the center will the focal point be?
 A. 2 ft B. 4 ft C. 8 ft D. 16 ft E. 20 ft
14. [10.2/~47] An arch is semi-elliptical with a base that is 26 ft wide and a height at the center that is 12 ft. How high is the arch 5 ft from the center of the base?
 A. 4.6 ft B. 7.38 ft C. 11.08 ft D. 12.0 ft E. 26 ft
15. [6.4/Example 2] Express $\cos 3\theta$ in terms of $\cos \theta$.
 A. $4\cos^2 \theta - 3$ B. $3\cos^3 \theta - 4\cos \theta$ C. $3\cos \theta - 4\cos^3 \theta$
 D. $4\cos \theta - 3\cos^3 \theta$ E. $4\cos^3 \theta - 3\cos \theta$
16. [10.4/29] Find the parametric equations of an ellipse with center (h, k) , axes of lengths $2a$ and $2b$, and whose major axis is horizontal.
 A. $x = a \cos t + k, y = b \sin t + h, 0 \leq t \leq 2\pi$
 B. $x = b \sin t + k, x = y \cos t + h, 0 \leq t \leq 2\pi$
 C. $x = b \sin t + h, x = y \cos t + k, 0 \leq t \leq 2\pi$
 D. $x = a \cos t + h, y = b \sin t + k, 0 \leq t \leq \pi$
 E. $x = a \cos t + h, y = b \sin t + k, 0 \leq t \leq 2\pi$
17. [10.6/Example 2] Find the eccentricity of the conic whose polar equation is

$$r = \frac{10}{2 + 3 \sin \theta}$$

 A. $\frac{2}{3}$ B. $\frac{3}{2}$ C. 3 D. 2 E. 10
18. [6.3/~18] If $\tan \alpha = -\frac{4}{3}$, α is a second quadrant angle, $\cot \beta = \frac{3}{4}$, and β is a third quadrant angle, find $\cos(\alpha + \beta)$.
 A. $\frac{24}{25}$ B. $-\frac{24}{25}$ C. 0 D. -1 E. 1

19. [7.2/~Example 2] In an oblique triangle ABC , if $a = 34.0$, $b = 20.0$, and $c = 18.0$, find the angle γ .

- A. 25.1° B. 28.1° C. 126.9° D. 129.6° E. 132.9°

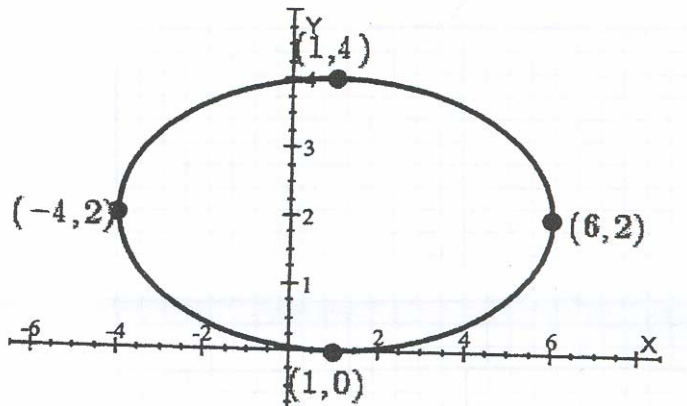
20. [10.5/~Example 1] Change the polar coordinates $\left(4, \frac{5\pi}{6}\right)$ into rectangular coordinates.

- A. $(-2, 2\sqrt{3})$ B. $(-\sqrt{3}, 1)$ C. $(4\sqrt{3}, 4)$ D. $(-2\sqrt{3}, 2)$
 E. $(-2\sqrt{3}, -2)$

INSTRUCTIONS FOR PART II: For these questions, you must write down **all** steps in your solutions **as if you did not have a calculator**. Write legibly and carefully label any graphs or pictures. **Draw a box around your solution**. Partial credit will be given for those parts of your solution that are correct. Each of the questions in this section counts 5 points, for a total possible score of 20 points.

21. [3.3/~1-4] Find a polynomial $f(x)$ of degree 3 that has zeros $-1, 2, 3$ and for which $f(4) = -40$. Write your answer in the form $f(x) = ax^3 + bx^2 + cx + d$.

22. [10.2/~18] Write an equation for the ellipse whose graph is given below. Write your answer in the general form $Ax^2 + Cy^2 + Dx + Ey + F = 0$.



23. [6.6/~17a] Evaluate exactly: $\sin\left(\sin^{-1}\frac{1}{2} + \cos^{-1}0\right)$. Show all steps.

24. [7.1/~Example 4] A course for a skateboard race consists of a 200-meter downhill run and a 150-meter level portion. The angle of elevation of the starting point of the race from the finish line is 27.4° . What angle does the hill make with the horizontal? Your work should include a carefully labeled sketch.