

Midterm 2 – 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 $4\frac{1}{2}$ points, for a total possible score of 72 points. You may use an approved calculator. You may write on this exam or request scratch paper if needed.

1. [3.5/~ Examples 3 and 7] Find a zero of the rational function with equation

$$f(x) = \frac{a(2x+b)(x+c)}{(x+c)(3x-d)(x+e)}.$$

- A. $\left(\frac{d}{3}, 0\right)$ B. $(-e, 0)$ C. $\left(-\frac{b}{2}, 0\right)$ D. $\left(-\frac{e}{a}, 0\right)$ E. $(-b, 0)$

2. [5.1/~ 45, 46] A wheel of radius 8 inches is rotating at the rate of 810 rpm. Find the linear speed of a point on the circumference in feet per minute.

- A. 540π ft/min B. 1080π ft/min C. 6480π ft/min D. $12,960\pi$ ft/min
E. 1240π ft/min

3. [5.2/~ 79] Find the exact value of $\sec \theta$ if θ is in standard position with the terminal side in Quadrant II and parallel to the line $5x + 2y - 3 = 0$.

- A. $-\frac{\sqrt{29}}{2}$ B. $-\frac{\sqrt{29}}{5}$ C. $-\frac{\sqrt{21}}{5}$ D. $\frac{\sqrt{21}}{5}$ E. $-\frac{5}{2}$

4. [5.6/~ 15 and 16] Find one asymptote for the graph of $y = a \tan\left(bx - \frac{\pi}{6}\right)$, $b > 0$.

- A. $x = -\frac{\pi}{6b}$ B. $x = \frac{\pi}{6b}$ C. $x = -\frac{2\pi}{3b}$ D. $x = \frac{2\pi}{3b}$ E. $x = \frac{\pi}{3b}$

5. [5.7/22] Given triangle ABC with $\gamma = 90^\circ$, express c in terms of β and a .

- A. $c = a \csc \beta$ B. $c = a \sec \beta$ C. $c = a \sin \beta$ D. $c = a \tan \beta$
E. $c = a \cos \beta$

6. [5.7/~28] A guy wire is attached to the top of a pole and to a point on horizontal ground that is 50.0 ft from the base of the pole. If the wire makes an angle of $52^\circ 40'$ with the ground, approximate the length of the wire.
 A. 62.88 ft B. 65.56 ft C. 73.87 ft D. 79.86 ft E. 82.45 ft
7. [6.2/~ 18] Find all solutions to $\cos\left(4x - \frac{\pi}{4}\right) = \frac{\sqrt{3}}{2}$. (Note: n is an integer in the answers below.)
 A. $\frac{5\pi}{48} + \frac{\pi}{2}n, \frac{25\pi}{48} + \frac{\pi}{2}n$ B. $\frac{5\pi}{48} + \frac{\pi}{3}n, \frac{25\pi}{48} + \frac{\pi}{3}n$ C. $\frac{5\pi}{48} + \frac{2\pi}{3}n, \frac{25\pi}{48} + \frac{2\pi}{3}n$
 D. $\frac{5\pi}{48} + \frac{\pi}{4}n, \frac{25\pi}{48} + \frac{\pi}{4}n$ E. $\frac{5\pi}{48} + 2\pi n, \frac{25\pi}{48} + 2\pi n$
8. [3.2/~9] Find the phase shift of the graph of the equation $y = -r \sin(-cx + k)$, where r , c , and k are all nonzero constants.
 A. $-\frac{k}{c}$ B. $\frac{k}{c}$ C. $-\frac{c}{k}$ D. $\frac{c}{k}$ E. $\frac{c}{r}$
9. [5.3/~ 5] Find the rectangular coordinates of the point P on the unit circle that correspond to $t = -\frac{\pi}{2}$.
 A. $(-1, 0)$ B. $(0, -1)$ C. $(0, 1)$ D. $(1, 0)$ E. $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
10. [7.1/~20] A cable to the top of a tower makes an angle of 35° with the level ground. At a point 100 yards closer to the tower, the angle of elevation to the top of the tower is 59° . Estimate the length of the cable, to the nearest yard.
 A. 150 yards B. 181 yards C. 201 yards D. 211 yards E. 242 yards
11. [6.3/17] If $\sin \alpha = -\frac{4}{5}$ and $\sec \beta = \frac{5}{3}$ for a third-quadrant angle α and a first-quadrant angle β , find the quadrant containing $\alpha + \beta$.
 A. I B. II C. III D. IV
 E. not enough information has been given

12. [5.7/~15] Given triangle ABC with $\gamma = 90^\circ$, $c = 6.2$ and $a = 4.1$, find the measure of angle β to the nearest whole degree.
 A. 41° B. 43° C. 49° D. 47° E. 52°
13. [3.5/~ Example 3] Find the vertical asymptote of the rational function $f(x) = \frac{3x-12}{4x-2}$.
 A. $x = \frac{1}{2}$ B. $x = 0.499$ C. $x = 2$ D. $x = \frac{3}{4}$
 E. There are no vertical asymptotes.
14. [7.1/18] To determine the distance between the two points A and B , a surveyor chooses a point C that is 375 yards from A and 530 yards from B . If $\angle BAC$ has measure $49^\circ 30'$, approximate the distance between A and B .
 A. 219 yards B. 326 yards C. 495 yards D. 513 yards E. 690 yards
15. [7.2/17] Two automobiles leave a city at the same time and travel along straight highways that differ in direction by 84° . If their speeds are 60 mi/hr and 45 mi/hr, respectively, approximately how far apart are the cars at the end of 20 minutes?
 A. 48 mi B. 36 mi C. 24 mi D. 15 mi E. 12 mi
16. [6.6/25] Write the expression $\sec\left(\sin^{-1}\frac{x}{\sqrt{x^2+4}}\right)$ as an algebraic expression in x for $x > 0$.
 A. $\frac{2}{\sqrt{x^2+4}}$ B. $\sqrt{x^2+4}$ C. $\frac{x}{\sqrt{x^2+4}}$ D. $\frac{\sqrt{x^2+4}}{2}$ E. $\frac{\sqrt{x^2+4}}{x}$

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 7 points, for a total possible score of 28 points.

17. [5.2/44] Use fundamental identities to write $\tan \theta$ in terms of $\cos \theta$ for any acute angle θ .
18. [6.1/36] Verify the identity: $\frac{\csc x}{1 + \csc x} - \frac{\csc x}{1 - \csc x} = 2 \sec^2 x$

19. [6.4/18] Verify the identity: $\sin 4\theta = 4 \sin \theta \cos \theta (1 - 2 \sin^2 \theta)$.

20. [6.2/~ 42-50] Find the solutions of the following equation that are in the interval $[0, 2\pi]$.

All steps must be clearly shown and solutions must be exact.

$$\sin\left(2x - \frac{\pi}{8}\right) = 0$$