1. Find the vertex, focus, and directrix of the parabola.
   \[ y = x^2 - 4x + 2 \]
   (11.1 #9)
   
   \[ \text{1. } \text{__________________________} \ (4) \]

2. Find an equation of the ellipse that has its center at the origin with horizontal major axis of length 8, minor axis of length 5.

   (11.2 #29)

   \[ \text{2. } \text{__________________________} \ (4) \]

3. Find the center, vertices, the foci, and the equations of the asymptotes of the hyperbola. Sketch its graph.

   \[ \frac{(y+2)^2}{9} - \frac{(x+2)^2}{4} = 1 \]
   (11.3 #11)

   \[ \text{(4)} \]

   \[ \text{y} \]

   \[ \text{x} \]
4. Solve the system. 
\[ \begin{cases} y^2 - 4x^2 = 4 \\ 9y^2 + 16x^2 = 140 \end{cases} \] 
(9.1 #25) 

\[ 4. \] 

(4) 

5. **Mixing a silver alloy**  A silversmith has two alloys, one containing 35% silver and the other 60% silver. How much of each should be melted and combined to obtain 100 grams of an alloy containing 50% silver?  
(9.2 #31) 

\[ 5. \] 

(4) 

6. a) Find the radian and degree measures of the central angle \( \theta \) subtended by an arc of 7 cm on a circle of radius 4 cm. 
(6.1 #33) 

\[ 6a. \] 

(4) 

b) Find the area of the sector determined by \( \theta \) in part (a). 

\[ 6b. \] 

(4)
7. A wheel of radius 5 inches is rotating at a rate of 40 rpm.
   a) Find the angular speed (in radians per minute).

   \[ \text{Angular Speed} = 40 \text{ rpm} \times \frac{2\pi \text{ rad}}{60 \text{ sec}} \]

   \[ \text{Angular Speed} = \frac{40 \times 2\pi}{60} \text{ rad/min} \]

   \[ \text{Angular Speed} = \frac{2\pi}{3} \text{ rad/min} \]

   7a) \underline{\frac{2\pi}{3}} \text{ rad/min} (4)

   b) Find the linear speed of a point on the circumference (in ft/min).

   \[ \text{Linear Speed} = \text{Angular Speed} \times \text{Radius} \]

   \[ \text{Linear Speed} = \frac{2\pi}{3} \times 5 \text{ ft/min} \]

   \[ \text{Linear Speed} = \frac{10\pi}{3} \text{ ft/min} \]

   7b) \underline{\frac{10\pi}{3}} \text{ ft/min} (4)

8. Find the exact values of \( \sin \theta \), \( \cos \theta \) and \( \tan \theta \) for the acute angle \( \theta \) if \( \sec \theta = \frac{6}{5} \).

   \[ \sec \theta = \frac{6}{5} \]

   \[ \cos \theta = \frac{5}{6} \]

   \[ \sin \theta = \sqrt{1 - \cos^2 \theta} = \sqrt{1 - \left(\frac{5}{6}\right)^2} = \frac{\sqrt{11}}{6} \]

   \[ \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{\sqrt{11}}{6}}{\frac{5}{6}} = \frac{\sqrt{11}}{5} \]

   8. \underline{\frac{\sqrt{11}}{6}, \frac{5}{6}, \frac{\sqrt{11}}{5}} (4)

9. Find the exact value.

   \[ \csc(-2\pi/3) \]

   \[ \csc(-2\pi/3) = \frac{1}{\sin(-2\pi/3)} = \frac{1}{\sin(\pi - \pi/3)} = \frac{1}{\sin(\pi/3)} = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}} \]

   9. \underline{\frac{2}{\sqrt{3}}} (4)

10. Graph at least one complete period of \( y = 1 + \csc x \).

    \[ y = 1 + \frac{1}{\sin x} \]

    (4)
11. Find the amplitude, period, phase shift, and graph at least one complete period for \[ y = -5 \cos \left( \frac{4}{5} x + \frac{\pi}{6} \right). \] (6.5 #31)

12. Given the indicated parts of triangle ABC with \( \gamma = 90^\circ \), express the third part in terms of the first two.
\[ \beta, b; a \] (6.7 #19)

13. A rocket is fired at sea level and climbs at a constant angle of \( 75^\circ \) through a distance of 10,000 feet. Approximate its altitude to the nearest foot. (6.7 #31)

14. Verify the identity. Show all work. (7.1 #23)
\[ \tan^4 k - \sec^4 k = 1 - 2 \sec^2 k \] (4)
15. Find the **exact values** of the solutions of the equation that are in the interval \([0, 2\pi)\). 

\[2 \sin^2 u = 1 - \sin u\]

15. ________________ (4)

16. If \(\cos \alpha = -\frac{2}{5}\) and \(\cos \beta = -\frac{3}{5}\) for third-quadrant angles \(\alpha\) and \(\beta\), find the **exact value** for:

\(\cos(\alpha - \beta)\)

16a) ________________ (4)

\(\sin(\alpha - \beta)\)

16b) ________________ (4)

17. Given \(\sec \theta = -3\); \(90^\circ < \theta < 180^\circ\) find the **exact value** of \(\sin 2\theta\), \(\cos 2\theta\) and \(\tan 2\theta\).

17a) \(\sin 2\theta\): ________________ (4)

17b) \(\cos 2\theta\): ________________ (4)

17c) \(\tan 2\theta\): ________________ (4)
18. Find the **exact values** of the solutions of the equation that are in the interval \([0, 2\pi)\). 

\[
\sin 2t + \sin t = 0
\]

18. ______________________  (4)

19. Without using your calculator, find the **exact value** of the expression. 

\[
\csc \left[ \cos^{-1} \left( -\frac{1}{2} \right) \right]
\]

19. ______________________  (4)

20. Use inverse trigonometric functions to find the solutions of \(2 \tan^2 t + 9 \tan t + 3 = 0\) that are in \(\left( -\frac{\pi}{2}, \frac{\pi}{2} \right)\), and approximate the solutions to four decimal places.

20. ______________________  (4)
21. In triangle $ABC$ if $\alpha = 42^\circ10'$, $\gamma = 61^\circ20'$ and $b = 19.7$ find the value of side $a$. (8.1 #5)

$$\alpha = 42^\circ10', \gamma = 61^\circ20', b = 19.7$$

21. ____________________________ (4)

22. A triangular plot of land has sides of lengths 420 feet, 350 feet, and 180 feet. Approximate the smallest angle between the sides. (8.2 #18)

22. ____________________________ (4)

23. Approximate the area of a parallelogram that has sides of lengths $a$ and $b$ (in feet) if one angle at a vertex has measure $\theta$.

$a = 12.0$ ft, $b = 16.0$ ft, $\theta = 40^\circ$ (8.2 #43)

23. ____________________________ (4)

**Bonus:** Find all exact values for the solutions of the equation. (7.2 #17)

$$\sin\left(2x - \frac{\pi}{3}\right) = \frac{1}{2}$$

**Bonus:** ____________________________ (4)