Show all work and clearly indicate final answers in your blue books.

1. Solve exactly (no calculator approximations): $x^2 + 4x + 1 = 0$.

2. Find the center and radius for the circle given by $2x^2 + 4x + 2y^2 - 8y + 8 = 0$.

3. Solve the inequality: $\dfrac{x+1}{2x-1} < 0$.

4. Let $f(x) = \dfrac{2}{x+1}$. Find $f^{-1}(x)$ and verify your answer by calculating $f(f^{-1}(x))$.

5. The price of a new machine is \$31,500. After 15 years, the machine has a salvage value of \$1,500. Assuming linear depreciation, find a formula for the value of the machine after t years, $0 \leq t \leq 15$.

6. Determine the following for the function $f(x) = \dfrac{x-1}{x^2 - 2x}$.

    a) Domain of f d) y-intercepts (if any)
    b) Range of f e) vertical asymptotes
    c) x-intercepts (if any)   f) Sketch the graph of $y = f(x)$.

7. Solve for x: $\log_2(x) - \log_2(x-2) = 1$.

8. The amount of the radioactive element sodium-24 in a sample after t hours is given by $N = N_0 e^{-0.047t}$, where N_0 is the current amount. If there are currently 2 g of sodium-24 in the sample, how long before there is only 1 g?

9. Give exact values for the following expressions (*not* calculator approximations). If the answer is in an angle, use radians.

    a) $\sin\left(\dfrac{5\pi}{3}\right)$ d) $\sin^{-1}\left(\dfrac{1}{2}\right)$

    b) $\cos(-120°)$ e) $\sin\left[\cos^{-1}\left(\dfrac{5}{13}\right)\right]$.

    c) $\tan\left(\dfrac{5\pi}{6}\right)$

1

10. Given that $\tan\theta = \frac{2}{3}$ and θ is in the third quadrant, find exact values for the other 5 trig functions of θ.

11. Graph at least one period of $y = 2\sin(3x - \pi)$. State clearly the amplitude, period, phase shift, and intercepts.

12. Find all solutions on the interval $[0, 2\pi)$ of $2\sin^2 x - \sin x = 0$.

13. To an observer standing 500 feet from the base of a radio tower, the angle of elevation of the top of the tower is $36°$. How high is the tower to the nearest foot.

14. A triangle has sides of $a = 5$, $b = 4$, and $c = 6$. (All measurements are given in feet.) Determine angle A of the triangle in degrees to one decimal place.

15. Solve the system
$$\begin{aligned} 2x &- y &= -5 \\ x &+ 2y &= 5. \end{aligned}$$

16. The polar coordinates of a point are $(2, \frac{5\pi}{6})$. Find the rectangular coordinates for the point.

17. Let $\mathbf{a} = \langle 1, 1 \rangle$ and $\mathbf{b} = \langle 3, 4 \rangle$. Find
   a) $\mathbf{a} + \mathbf{b}$
   b) $|\mathbf{b}|$.

18. Find the partial fraction decomposition: $\dfrac{x}{(x + 2)(x - 3)}$.