Answer all questions in the booklet provided. Each multiple choice question is worth 5 points; there is no partial credit. Each short answer question is worth 10 points; show all work to receive credit.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. Round 16.958741 to 3 decimal places.
   (a) 16.9  (b) 17.0  (c) 16.958  (d) 16.959  (e) None of the above

2. If a right triangle has hypotenuse 7 and one leg 2, what is the length of the other leg?
   (a) 9  (b) $\sqrt{63}$  (c) 5  (d) $3\sqrt{5}$  (e) None of the above

3. Factor as completely as possible: $162x^4y^2 - 2y^2z^8$
   (a) $2y^2(81x^4 - z^8)$  (b) $2(81x^4y^2 - y^2z^8)$  (c) $2y^2(9x^2 - z^4)^2$
   (d) $2y^2(9x^2 + z^4)(3x + z^2)(3x - z^2)$  (e) None of the above

4. Find the area $A$ and circumference $C$ of a circle with diameter 10.
   (a) $A = 100\pi$, $C = 20\pi$  (b) $A = 25\pi$, $C = 20\pi$  (c) $A = 25\pi$, $C = 10\pi$
   (d) $A = 100\pi$, $C = 10\pi$  (e) None of the above

5. Solve for $x$: $\frac{x^6}{x^2-1} = \frac{x^2}{x^2-1} + \frac{1}{x^2-1}$
   (a) $\pm 1$  (b) $-1, 0, 1$  (c) 5  (d) 6  (e) None of the above

6. Using the variable $x$, write the interval $(4, 6]$ as an inequality.
   (a) $4 < x < 6$  (b) $4 \leq x < 6$  (c) $4 < x \leq 6$  (d) $4 \leq x \leq 6$  (e) None of the above

7. Solve the inequality for $x$: $-10 \leq 2x - 8 < 4$
   (a) $[-10, 8)$  (b) $(-1, 6]$  (c) $[2, 6)$  (d) $[-1, 6)$  (e) None of the above
8. Solve for $x$: \(|x + 2| = 5\)
   (a) \{3\}  (b) \{-2, 5\}  (c) \{-7, 3\}  (d) \{-5, 0, 2\}  (e) None of the above

9. Write the equation for $x$ if $x$ varies directly with $P$ and inversely with $T$ squared.
   (a) $x = kPT$  (b) $x = kPT^2$  (c) $x = \frac{kP^2}{T^2}$  (d) $x = \frac{kP}{T}$  (e) None of the above

10. Find the equation of the line through the points $(-3, 1)$ and $(4, 0)$.
    (a) $y = -\frac{1}{7}x + \frac{9}{7}$  (b) $y = 7x + 4$  (c) $y = \frac{1}{7}x + \frac{10}{7}$  (d) $y = 4x$
        (e) None of the above

11. Where is the graph of the piecewise function $f(x) = \begin{cases} 
3x + 10 & \text{for } x < -2 \\
2x & \text{for } x \geq -2
\end{cases}$ increasing?
    (a) $(-\infty, -2) \cup (0, \infty)$  (b) $(-\infty, -2)$  (c) $(-2, \infty)$  (d) $(-2, 0)$  (e) None of the above

12. Find the equation of the line that is perpendicular to the line $y = 4x + 2$ and passes through the origin.
    (a) $y = \frac{1}{4}x$  (b) $y = 4x$  (c) $y = -\frac{1}{4}x$  (d) $y = -4x$  (e) None of the above

13. Find the equation of the circle with center $(4, 0)$ and radius 5.
    (a) $x^2 + (y-4)^2 = 5$  (b) $x^2 + (y-4)^2 = 25$  (c) $(x-4)^2 + y^2 = 5$  (d) $(x-4)^2 + y^2 = 25$
        (e) None of the above

14. Find the domain of the function $f(x) = \sqrt{x}$.
    (a) $x < 0$  (b) $x > 0$  (c) $x = 0$  (d) $x \geq 0$  (e) None of the above

15. Find the composite function $(f \circ g)(x)$ of $f(x) = \frac{2}{x}$ and $g(x) = \frac{5x}{x+1}$.
    (a) $\frac{10x}{x^2+2}$  (b) $\frac{10x}{x^2+2}$  (c) $\frac{10x}{x^2+2}$  (d) $\frac{10x}{x^2+2}$  (e) None of the above

16. Is the function $f(x) = x^2 + 2$ symmetric with respect to the $x$-axis, $y$-axis, or origin?
    (a) $x$-axis  (b) origin  (c) $y$-axis  (d) $x$-axis and $y$-axis  (e) None of the above
17. Find the vertical asymptote of the graph of \( f(x) = \frac{x+8}{x-4} \).
   (a) \( x = -8 \)  (b) \( x=4 \)  (c) \( x = 2 \)  (d) \( x = -4 \)  (e) None of the above

18. Find the vertex of the parabola with equation \( y = (x + 1)^2 - 2 \).
   (a) \((-2,1)\)  (b) \((-2, -1)\)  (c) \((1,2)\)  (d) \((-1,2)\)  (e) None of the above

19. Solve the inequality: \( x^2 + 5x \leq 24 \)
   (a) \([-\infty, 0] \cup [3, \infty]\)  (b) \([-8, 3]\)  (c) \([4, 6]\)  (d) \([-\infty, -8] \cup [3, \infty]\)  (e) None of the above

20. Find the number needed to complete the square of the expression: \( x^2 + \frac{3}{2}x \)
   (a) \( \frac{3}{8} \)  (b) \( \frac{3}{16} \)  (c) \( \frac{9}{16} \)  (d) \( \frac{9}{64} \)  (e) None of the above

Please continue to complete the SHORT ANSWER section on the next page.
SHORT ANSWER. Show all work.

21. Factor completely: (a) \( x^2 - 8x + 15 \) \hspace{1cm} (b) \( 27x^3 + 8 \)

22. If \( f(x) = \sqrt{x} \) and \( g(x) = x - 4 \), find the following:
   
   (a) \((f + g)(x)\) \hspace{1cm} (b) \((f \cdot g)(x)\) \hspace{1cm} (c) \((f \circ g)(x)\)

23. Simplify each expression. Write the answer to (b) in lowest terms with only positive exponents.
   
   (a) \(4\sqrt{32} - 2\sqrt{18}\) \hspace{1cm} (b) \(\frac{x^3y^4z^{-1}}{(xy)^3z^2}\)

24. Find all solutions to each equation:
   
   (a) \(\sqrt{2x - 5} + 2 = 9\) \hspace{1cm} (b) \(x^2 + 3x - 20 = 0\)

25. Graph the function \(f(x) = |x - 3| - 1\).

26. How much water must be evaporated from 10 gallons of a 20% salt solution to create a 25% solution?

27. Find the solution set. Graph it on the real line and express it in interval notation.
   
   \(-3 \leq \frac{4x - 1}{3} \leq 1\)

28. (a) Find an equation for the line through \((-4, -6)\) and \((3, 8)\). Graph it.
   
   (b) Find an equation of the perpendicular line through \((2, 0)\). Graph it on the same coordinate axes.

29. Find the center and radius of the circle with equation \(x^2 + y^2 - 2x - 6y + 6 = 0\), and graph it.

30. Find the domain of the rational function \(f(x) = \frac{1}{x+1} + 2\), and the equations of its horizontal and vertical asymptotes, if any.