1. The graph of a function $f$ is given.
   (a) State the value of $f(-1)$.
   (b) Estimate the value of $f(2)$.
   (c) For what values of $x$ is $f(x) = 2$?
   (d) Estimate the values of $x$ such that $f(x) = 0$.
   (e) State the domain and range of $f$.
   (f) On what interval is $f$ increasing?

2. The graphs of $f$ and $g$ are given.
   (a) State the values of $f(-4)$ and $g(3)$.
   (b) For what values of $x$ is $f(x) = g(x)$?
   (c) Estimate the solution of the equation $f(x) = -1$.
   (d) On what interval is $f$ decreasing?
   (e) State the domain and range of $f$.
   (f) State the domain and range of $g$.
   (g) Estimate. Show your steps.
   (i) $(f \circ g)(3)$  (ii) $(g \circ f)(-4)$  (iii) $(f \circ f)(0)$

3. Express the side length of a square as a function of the length $d$ of the square’s diagonal. Then express the area as a function of the diagonal length.

4. A box with an open top is to be constructed from a rectangular piece of cardboard with dimensions 14 in. by 22 in. by cutting out equal squares of side $x$ at each corner and then folding up the sides as in the figure. Express the volume $V$ of the box as a function of $x$.

5. Find the domain of the function $f(x)$.
   (a) $f(x) = 1 - \sqrt{x}$.
   (b) $f(x) = \frac{1}{\sqrt{4 - x^2}}$

6. Graph the functions. For each function determine its domain and range.
   (a) $f(x) = 5 - 2x$
   (b) $f(x) = 1 - 2x - x^2$
   (c) $f(x) = \begin{cases} x & \text{if } 0 \leq x \leq 1 \\ 2 - x & \text{if } 1 < x \leq 2 \end{cases}$
   (d) $f(x) = \begin{cases} 3 - x & \text{if } x \leq 1 \\ 2x & \text{if } x > 1 \end{cases}$

7. Graph the functions by shifting the graphs of the functions $\sqrt{x}$ or $\frac{1}{x}$ (as appropriate). For each function determine its domain and range.
   (a) $y = \sqrt{x} + 4$
   (b) $y = \frac{1}{x} + 2$
   (c) $y = \frac{1}{x + 2}$
8. Find the domains of \( f \), \( g \), \( f + g \), and \( f \cdot g \).
   \[(a) \ f(x) = x, \ g(x) = \sqrt{x - 1} \quad (b) \ f(x) = \sqrt{x + 1}, \ g(x) = \sqrt{x - 1} \]

9. Find the domains of \( f \), \( g \), \( f/g \), and \( g/f \) if \( f(x) = 2 \), \( g(x) = x^2 - 1 \)

10. If \( f(x) = x + 5 \) and \( g(x) = x^2 - 3 \), find the following.
    \[(a) \ f(g(0)) \quad (b) \ g(f(0)) \quad (c) \ f(g(x)) \quad (d) \ g(f(x)) \]

11. If \( u(x) = 4x - 5 \), \( v(x) = x^2 \) and \( f(x) = 1/x \), find formulas for the following.
    \[(a) \ u(v(f(x))) \quad (b) \ v(u(f(x))) \quad (c) \ f(u(v(x))) \]

12. (a) Write a formula for \( f \circ g \) and \( g \circ f \) and (b) find the domain of each.
    \[f(x) = \sqrt{x + 1}, \ g(x) = \frac{1}{x}\]

13. Complete the following table.

<table>
<thead>
<tr>
<th>( g(x) )</th>
<th>( f(x) )</th>
<th>( (f \circ g)(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( x - 7 )</td>
<td>( \sqrt{x} )</td>
<td>?</td>
</tr>
<tr>
<td>b. ( x + 2 )</td>
<td>( 3x )</td>
<td>?</td>
</tr>
<tr>
<td>c. ( ? )</td>
<td>( \sqrt{x - 5} )</td>
<td>( \sqrt{x^2 - 5} )</td>
</tr>
<tr>
<td>d. ( \frac{x}{x - 1} )</td>
<td>( \frac{x}{x - 1} )</td>
<td>?</td>
</tr>
<tr>
<td>e. ( ? )</td>
<td>( 1 + \frac{1}{x} )</td>
<td>( x )</td>
</tr>
<tr>
<td>f. ( \frac{1}{x} )</td>
<td>( ? )</td>
<td>( x )</td>
</tr>
</tbody>
</table>

14. Complete the following table of function values. If the function is undefined at a given angle, enter “UND”. Do not use a calculator or tables.

<table>
<thead>
<tr>
<th>( \theta )</th>
<th>( -\pi )</th>
<th>0</th>
<th>( \frac{\pi}{2} )</th>
<th>( \frac{3\pi}{4} )</th>
<th>( -\frac{\pi}{3} )</th>
<th>( -\frac{\pi}{6} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sin \theta )</td>
<td>( \cos \theta )</td>
<td>( \tan \theta )</td>
<td>( \cot \theta )</td>
<td>( \sec \theta )</td>
<td>( \csc \theta )</td>
<td></td>
</tr>
</tbody>
</table>
15. Graph the functions. What is the period of each function?
   (a) \( \sin 2x \)  
   (b) \( \sin(x/2) \)  
   (c) \( \cos \pi x \)  
   (d) \( \cos \left( x - \frac{\pi}{2} \right) \)

16. Find \( \cos x \) and \( \tan x \) if \( \sin x = \frac{3}{5} \), if \( x \in \left[ \frac{\pi}{2}, \pi \right] \).

17. Determine which of the following graphs are graphs of functions of \( x \) and which are not. Give reasons for your answers.

   (a)  
   (b)  
   (c)  
   (d)  

18. Say whether the function is even, odd, or neither. Give reasons for your answer.
   (a) \( f(x) = 3 \)  
   (b) \( f(x) = x^2 + 1 \)  
   (c) \( f(x) = x^2 + x \)  
   (d) \( f(x) = x^3 + x \)

19. Which of the functions whose graphs are shown below are even, which are odd, and which are neither even nor odd? Which of the functions are one-to-one and which are not?

   (a)  
   (b)  
   (c)  
   (d)  

20. Each of exercises, (a) and (b), gives a formula for a function \( y = f(x) \) and shows the graphs of \( f \) and \( f^{-1} \). Find a formula for \( f^{-1} \) in each case. Identify the domain and range of \( f^{-1} \).

   (a) \( f(x) = x^2 + 1, \quad x \geq 0 \)  
   (b) \( f(x) = x^3 - 1 \)
21. Solve for $x$:
   (a) $x^{1/3} = 2$  
   (b) $x^3 = 1/27$  
   (c) $\sqrt{x - 1} = 5$  
   (d) $3x^2 - 2x = 6 + x$  
   (e) $x^2 - 4x + 7 = 0$
   (f) $\frac{2x(x - 2) - (x^2 - 3)}{(x - 2)^2} = 0$  
   (g) $\frac{x^2}{\sqrt{x^2 + 1}} - \frac{x^2}{\sqrt{x^2 + 1}} = \frac{1}{2}$

22. Solve the following inequalities.
   (a) $1 - x \leq 3$  
   (b) $-x^2 + 2x + 8 \leq 0$  
   (c) $\frac{(x + 3)(x - 1)}{x - 2} \geq 0$

23. In each exercise, sketch the given curves together in the same coordinate plane and label each curve with its equation.
   (a) $y = 2^x$, $y = 3^x$, $y = (1/2)^x$  
   (b) $y = e^x$ and $y = 1/e^x$

24. Use the laws of exponents to simplify the expressions.
   (a) $9^{1/3} \cdot 9^{1/6}$  
   (b) $(25^{1/8})^4$  
   (c) $(e^{\sqrt{2}})^{\sqrt{2}/2}$

25. Express the following logarithms in terms of $\ln 2$ and $\ln 3$.
   (a) $\ln 0.75$  
   (b) $\ln(4/9)$  
   (c) $\ln(1/2)$  
   (d) $\ln(\sqrt{9})$  
   (e) $\ln 3\sqrt{2}$  
   (f) $\ln\sqrt{13.5}$

26. Use the properties of logarithms to simplify the expressions.
   (a) $\ln(\sin \theta) - \ln\left(\frac{\sin \theta}{5}\right)$  
   (b) $\ln(3x^2 - 9x) + \ln\left(\frac{1}{3x}\right)$  
   (c) $\frac{1}{2}\ln(4t^4) - \ln 2$

27. Find simpler expressions for the quantities.
   (a) $e^{\ln 7.2}$  
   (b) $e^{-\ln x^2}$  
   (c) $e^{\ln x - \ln y}$
   (d) $2\ln \sqrt{e}$  
   (e) $\ln(\ln e^e)$  
   (f) $\ln(e^{-x^2-y^2})$

28. Solve for $y$ in terms of $t$ or $x$, as appropriate.
   (a) $\ln y = 2t + 4$  
   (b) $\ln(y - 1) - \ln 2 = x + \ln x$  
   (c) $\ln(y^2 - 1) - \ln(y + 1) = \ln(\sin x)$

29. Solve for $t$.
   (a) $e^{-0.3t} = 27$  
   (b) $e^{kt} = \frac{1}{2}$  
   (c) $e^{(\ln 0.2)t} = 0.4$  
   (d) $e^{\sqrt{7}} = x^2$