Preliminary Review Problems - Calculus 1
These problems are intended to be done without the use of a calculator

**Question 1:** Let \( f(x) = x^2 + 5x \)

(a) Solve the equation \( f(x) = -6 \)  
(b) Solve the inequality \( f(x) > -6 \)

(c) Solve the equation \( f(x) = 1 \)  
(d) Solve the inequality \( f(x) < 1 \)

**Question 2:**
Among the parabolas shown in a dashed line on the graph at right, identify the one whose equation is: \( y = (x - a)^2 + b \) with \( a < 0 \) and \( b > 0 \),

**Question 3:** Find the domain \( D_f \) of the function \( f(x) \). Give your answer in interval notation (i.e., as an interval or a union of intervals).

(a) \( f(x) = \sqrt[3]{x - 1} \)

(b) \( f(x) = \sqrt{3 - x^2} \)

(c) \( f(x) = \frac{x}{x + 4} \)

(d) \( f(x) = \sqrt{3 - x} + \frac{x}{\sqrt{x + 4}} \)

**Question 4:** Find the domain \( D_f \) and the range \( R_f \) of \( f(x) \). Give your answers in interval notation.

(a) \( f(x) = 10e^x \) \( D_f = \) \( R_f = \)

(b) \( f(x) = \ln(x - 4) \) \( D_f = \) \( R_f = \)

(c) \( f(x) = -5 \cos(2x) \) \( D_f = \) \( R_f = \)
**Question 5:** Find the functions $f \circ g$ and $g \circ f$ and give their domains, $D_{f \circ g}$ and $D_{g \circ f}$.

Given:

$$f(x) = \sin x \quad \text{and} \quad g(x) = \frac{1}{x + 2}$$

$$f \circ g = \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad D_{f \circ g} =$$

$$g \circ f = \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad D_{g \circ f} =$$

**Question 6:** Given the right triangle in the figure below, express $\cos \theta$, $\csc \theta$, and $\tan \theta$ in terms of $x$.

![Right Triangle](image)

**Question 7:** Find the lengths of the sides $x$ and $y$ in the right triangle pictured below.

![Right Triangle](image)

**Question 8:** Simplify the expressions using appropriate trigonometric identities.

(a) $\tan^2 \theta - \frac{1}{\cos^2 \theta}$  
(b) $\frac{8 - 8 \cos^2 \theta}{\sin \theta}$

**Question 9:** Find all values of $\theta$ in the interval $0 < \theta < \pi$ such that $4 \cos^2 \theta - 1 = 0$.

**Question 10:** Find the exact value of each expression.

(a) $\tan(2\pi)$  
(b) $\sin \left(\frac{3\pi}{4}\right)$  
(c) $\csc \left(\frac{\pi}{3}\right)$

(d) $\arctan(-1)$  
(e) $\cos^{-1}(-1)$  
(f) $\sec^{-1}(2)$
**Question 11:** Simplify using Laws of Exponents. (in (a) the answer is a number, in (b) - a power of $x$).

(a) $\left(\frac{1}{25}\right)^{-3/2}$  

(b) $\frac{x}{\sqrt[3]{x^3}}$

**Question 12:** Find the exact value of the expression.

(a) $\ln 4 - \ln(4e^5)$  

(b) $e^{-\ln 2}$

**Question 13:** Express the given quantity as a single logarithm. Simplify the expression inside this logarithm when possible.

(a) $3 \ln 3 + 2 \ln 2$

(b) $\ln(3x^2) - 4 \ln(\sqrt{x})$

(c) $2 \ln(\cos x) + \ln(\sec x)$

**Question 14:** Solve each equation for $x$.

(a) $e^{5x-2} = 3$  

(b) $\ln(x + 2) = \ln 7 + \ln x$

**Question 15:** For the function $h(x)$ find a pair of functions $f(x)$ and $g(x)$ (where $f(x) \neq x$ and $g(x) \neq x$) such that $h(x) = (f \circ g)(x)$.

(a) $h(x) = \sqrt{e^x + 1}$  

(c) $g(x) = $

(b) $h(x) = \tan(x^3)$  

(d) $g(x) = $