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 $f(x) = -6$

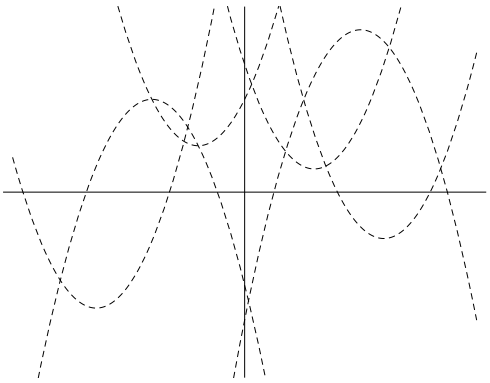
(**b**) Solve the inequality $f(x) > -6$

(**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 $\boldsymbol{a < 0}$ and $\boldsymbol{b > 0}$,



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**) $f(x) = \dfrac{x}{x + 4}$

(**d**) $f(x) = \sqrt{3 - x} + \dfrac{x}{\sqrt{x + 4}}$.

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

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

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

(**c**) $f(x) = -5\cos(2x)$ $\quad D_f =$ $\quad R_f =$

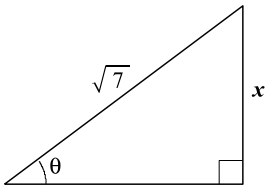
Question 5: Find the functions $f \circ g$ and $g \circ f$ and give their domains, $D_{f\circ g}$ and $D_{g\circ f}$.

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

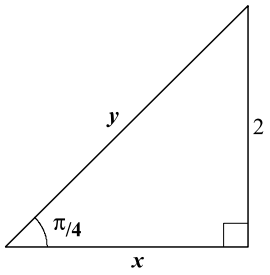
$f \circ g =$ $\qquad\qquad$ $D_{f\circ g} =$

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

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



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



Question 8: Simplify the expressions using appropriate trigonometric identities.

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

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

Question 10: Find the exact value of each expression.

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

(**d**) $\arctan(-1)$ $\qquad$ (**e**) $\cos^{-1}(-1)$ $\qquad$ (**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**) $\frac{x}{\sqrt[5]{x^3}}$

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**) $h(x) = \sqrt{e^x + 1}$ $f(x) =$ $g(x) =$

(**b**) $h(x) = \tan(x^3)$ $f(x) =$ $g(x) =$