1. (20 points) Solve the equation for $x$: $|5 - \frac{1}{x}| = 2$.

Solution: Note that $|5 - \frac{1}{x}| = 2 \iff 5 - \frac{1}{x} = \pm 2$. And so

$$5 - \frac{1}{x} = 2 \implies 5x - 1 = 2x \implies x = \frac{1}{3}$$

or

$$5 - \frac{1}{x} = -2 \implies 5x - 1 = -2x \implies x = \frac{1}{7}.$$ 

Thus $x = \frac{1}{3}$ or $x = \frac{1}{7}$.

2. (20 points) The relationship between Fahrenheit (F) and Celsius (C) temperature scales is given by the linear function $F = \frac{9}{5}C + 32$, where the given temperature is in degrees Celsius, and the output is in Fahrenheit.

(a) What is the slope of the graph and what does it represent?

Solution: The slope is $\frac{9}{5}$ and it represent the change in $^\circ$F for every $1^\circ$C change.

(b) What is the F-intercept and what does it represent?

Solution: The F-intercept is 32, and it represents the equivalent of $0^\circ$C in F.

3. (20 points) For $f(x) = \frac{x}{5} - 7$ and $g(x) = \frac{3x}{2} + 5$, find

(a) $f(x) + g(x) = \frac{17x}{10} - 2$.

(b) $f \circ g)(x) = f \left( \frac{3x}{2} + 5 \right) = \frac{3x}{5} + 5 - 7 = \frac{3x}{10} - 6$. 
4. (20 points) Express the given quantity as a single logarithm (show your work):

\[ 20 + 3 \log_3 7(2x - 1) - \frac{1}{2} \log_3 x. \]

Solution:

\[ 20 + 3 \log_3 7(2x - 1) - \frac{1}{2} \log_3 x = 20 \log_3 3 + \log_3 [7(2x - 1)]^3 - \log_3 x^{\frac{1}{2}} \]

\[ = \log_3 3^{20} + \log_3 7^3 (2x - 1)^3 - \log_3 \sqrt{x} \]

\[ = \log_3 \frac{3^{20} \cdot 7^3 \cdot (2x - 1)^3}{\sqrt{x}}, \quad x > \frac{1}{2} \]

Note that \( x > \frac{1}{2} \) since the log exists as long as \( \frac{3^{20} \cdot 7^3 \cdot (2x - 1)^3}{\sqrt{x}} \) is defined (namely \( x > 0 \) needed for the denominator) as well as \( \frac{3^{20} \cdot 7^3 \cdot (2x - 1)^3}{\sqrt{x}} > 0 \) (since that the input for the log needs to be positive, giving that it must be the case that \( x > \frac{1}{2} \)).

5. (20 points) Find the graph of \( f(x) = 3e^{x-2} \) without using the calculator (show the intermediate graphs).

Solution:

Solution:

![Graphs](image.png)

Figure 1: The graphs \( e^x, e^{x-2} \) and \( 3e^{x-2} \)