Part II: Compute the Fourier Transforms for the signals below.
Use the Fourier Transform pairs and properties on the slide; they tend to make life easier!

1. \( x(t) = \frac{5}{9 + j2\pi t} \) (25 points)

From the table:
\[ x(t) = e^{-a t} u(t) \iff X(f) = \frac{1}{a + j2\pi f} \]

Duality:
\[ X(t) = \frac{1}{a + j2\pi f} \iff x(-t) = e^{a t} u(-t) \]

So:
\[ X(f) = \frac{5}{9 + j2\pi f} \iff x(f) = 5 e^{j2\pi f} \]

2. \( x(t) = \text{rect} \left( \frac{t - 10}{8} \right) \) (25 points)

From table:
\[ x(t) = \text{rect}(t) \iff X(f) = \frac{1}{8} \left[ \text{sinc} \left( \frac{4}{8} f \right) \right] \]

Time scaling:
\[ x \left( \frac{t}{8} \right) \iff X(f) = \frac{1}{8} \left[ \text{sinc} \left( \frac{4}{8} f \right) \right] \]

Time shifting:
\[ x(t - 10) \iff X(f) = 8 \text{sinc}(4f) e^{-j2\pi 10f} \]

Notation: \( \text{sinc}(x) = \frac{\sin(x \pi)}{\pi x} \); \( \text{rect}(t) = 1 \) if \( |t| \leq 1/2 \), and \( \text{rect}(t) = 0 \) otherwise.

Part II: Compute the Fourier Transforms for the signals below.
Use the Fourier Transform pairs and properties on the slide; they tend to make life easier!

1. \( x(t) = \frac{2}{5 + j2\pi t} \) (25 points)

From the table:
\[ x(t) = e^{-a t} u(t) \iff X(f) = \frac{1}{a + j2\pi f} \]

Duality:
\[ X(t) = \frac{1}{a + j2\pi f} \iff x(-t) = e^{a t} u(-t) \]

So:
\[ X(f) = \frac{2}{5 + j2\pi f} \iff x(f) = 2 e^{j2\pi f} \]

2. \( x(t) = \text{rect} \left( \frac{t - 5}{4} \right) \) (20 points)

From table:
\[ x(t) = \text{rect}(t) \iff X(f) = \frac{1}{2} \left[ \text{sinc} \left( \frac{4}{4} f \right) \right] \]

Time scaling:
\[ x \left( \frac{t}{4} \right) \iff X(f) = \frac{1}{4} \text{sinc}(4f) \]

Time shifting:
\[ x(t - 5) \iff X(f) = 4 \text{sinc}(4f) e^{-j2\pi 5f} \]

Notation: \( \text{sinc}(x) = \frac{\sin(x \pi)}{\pi x} \); \( \text{rect}(t) = 1 \) if \( |t| \leq 1/2 \), and \( \text{rect}(t) = 0 \) otherwise.
Part II: Compute the Fourier Transforms for the signals below.
Use the Fourier Transform pairs and properties on the slide; they often make life easier!

1. \( x(t) = \frac{2}{4 + j2\pi t} \) (25 points)

From the table:
\( x(t) = e^{-at} u(t) \iff X(f) = \frac{1}{a+j2\pi f} \)
Duality:

\( X(u) = \frac{1}{a+j2\pi t} \iff X(f) = e^{a\phi} u(\cdot - f) \)
So
\( x(t) = \frac{2}{4 + j2\pi t} \iff X(f) = 2 e^{j2\pi f} \)

Notation: \( \text{sinc}(x) = \frac{\sin(\pi x)}{\pi x} \); \( \text{rect}(t) = 1 \) if \( |t| \leq 1/2 \), and \( \text{rect}(t) = 0 \) otherwise.

2. \( x(t) = \text{rect} \left( \frac{t - 3}{5} \right) \) (25 points)

From the table:
\( x(t) = \text{rect}(t) \iff X(f) = \frac{1}{2\pi} \text{sinc} \left( \frac{f}{15} \right) \)
Time scaling:
\( x(t) = \text{rect}(t) \iff X(f) = 2 \text{sinc}(15f) e^{-j6\pi f} \)

Notation: \( \text{sinc}(x) = \frac{\sin(\pi x)}{\pi x} \); \( \text{rect}(t) = 1 \) if \( |t| \leq 1/2 \), and \( \text{rect}(t) = 0 \) otherwise.