The current in a certain diode is governed by the equation \( I_D = I_{ss} \exp(V_D/V_t) \)

The small signal resistance of the diode is \( r_d = dV/dI \). Find \( r_d \) in terms of \( I_D \) and \( V_t \).

\[
\frac{1}{r_d} = \frac{1}{V_t} I_{ss} \exp\left(\frac{V_D}{V_t}\right) = \frac{I_D}{V_t}
\]

\[
r_d = \frac{V_t}{I_D}
\]

A model for a bipolar transistor is shown in Fig.1. The small signal resistance of the emitter to base diode is \( r_e \).

Find the transistor \( g_m = dI_C/dV_{BE} \). Neglect base current.

\[
g_m = \frac{1}{r_e}
\]

A certain bipolar transistor is governed by the equation \( I_C = \beta_F I_B (1 + V_{CE}/50) \).

If \( I_C = 10 \text{mA}, I_B = 50 \mu\text{A}, \text{and } V_{CE} = 20\text{V} \), find \( \beta_F \).

\[
\beta_F = \frac{10}{.05}/(1+2/5) = 142.9
\]

\[
\beta_F =
\]

A certain JFET transistor is governed by the equation \( I_D = I_{DSS}(V_{GS}/V_t+1)^2(1+\lambda V_{DS}) \)

Find the transistor \( g_m = dI_D/dV_{GS} \)

\[
g_m = 2\left(I_{DSS}/V_t\right)(V_{GS}/V_t+1)(1+\lambda V_{DS})
\]

\[
gm =
\]