

1. A doctor prescribes an initial dose of 150 milligrams of some drug to be followed by a maintenance dose of 30 milligrams each day. Suppose that 10% of the amount of this drug in the bloodstream is eliminated via the kidneys each day. Let $u(n)$ represent the number of milligrams of this drug in the patient's body n days after the initial dose.

- (a) Determine a discrete dynamical system along with an initial value for $u(n)$.

$$u(n) = 0.9u(n-1) + 30$$

$$u(0) = 150$$

- (b) How many milligrams of this drug are in the bloodstream 5 days after the initial dose?

$$u(5) = 211.43$$

- (c) After the initial dose, it takes between $\boxed{10}$ and $\boxed{11}$ days for the amount of drug in the bloodstream to reach a level of 250 milligrams.

- (d) Assuming that the patient is to continue taking this drug for a long time, what was the doctor's **target goal** for the desired amount of this drug in the bloodstream?

$$300 \text{ mg}$$

2. Suppose that 40 milligrams of drug U and 60 milligrams of drug V are taken each day. The kidneys remove 30% of U and 20% of V each day. The liver metabolizes these drugs causing 8% of U to be converted into V and 5% of V to be converted into U each day. Let $u(n)$ and $v(n)$ represent the number of milligrams of U and V , respectively, in the bloodstream n days after the initial dose.

- (a) Develop a discrete model to represent $u(n)$ and $v(n)$.

$$u(n) = 0.62u(n-1) + 0.05v(n-1) + 40$$

$$v(n) = 0.08u(n-1) + 0.75v(n-1) + 60$$

$$u(0) = 40$$

$$v(0) = 60$$

- (b) How many milligrams of U and V are in the bloodstream 6 days after the initial dose?

$$124.98 \text{ mg of } U \text{ and } 234.22 \text{ mg of } V$$
