b) $T = (0,1)$, $A_t = (t, t+1)$

① Najdeme $\bigcap\limits_{t \in T} A_t$

1) $x = 1 \Rightarrow \forall t \in T: \quad x > t \wedge x < t+1 \Rightarrow \overset{\forall t \in T:}{t < x < t+1} \Rightarrow \forall t \in T: x \in A_t.$

2) $x \in R \wedge x \neq 1 \Rightarrow$

$\forall \varphi \in R, \varphi > 0: \ x = 1 + \varphi \Rightarrow \exists t = 0 + \alpha \in T: \quad \alpha = \frac{\varphi}{2} \Rightarrow$
$\exists t : A_t = (0 + \frac{\varphi}{2}, 1 + \frac{\varphi}{2}) \Rightarrow x \notin A_t$

$\forall \varphi \in R, \varphi > 0: \ x = 1 - \varphi \Rightarrow \exists t = 1 - \alpha \in T: \quad \alpha = \frac{\varphi}{2} \Rightarrow$
$\exists t : A_t = (1 - \frac{\varphi}{2}, 2 - \frac{\varphi}{2}) \Rightarrow x \notin A_t$

$$\boxed{\bigcap_{t \in T} A_t = \{1\}}$$

② Najdeme $\bigcup\limits_{t \in T} A_t$

1) $1 \in \bigcap\limits_{t \in T} A_t \Rightarrow 1 \in \bigcup\limits_{t \in T} A_t$

2) $\forall x \in R: \ x \in (0,2) \wedge x \neq 1 \Rightarrow$

$x = 0 + \alpha \wedge 0 < \alpha < 1 \Rightarrow \exists\, t = \frac{\alpha}{2} \in T:$
$0 < t < x < 1 < t+1 \Rightarrow \exists\, t \in T: x \in (t, t+1)$
$\Rightarrow \exists t: \ x \in A_t.$

$x = 2 - \alpha \wedge 0 < \alpha < 1 \Rightarrow \exists t = 1 - \frac{\alpha}{2} \in T:$
$0 < t < 1 < x < t+1 \Rightarrow \exists\, t \in T: x \in (t, t+1)$
$\Rightarrow \exists t: \ x \in A_t.$

3) $\forall x \in R: \ x \leq 0 \Rightarrow \forall t \in T: \ t > x \Rightarrow \forall t \in T: \ x \notin (t, t+1) \Rightarrow \forall t \in T: x \notin A_t.$

4) $\forall x \in R: \ x \geq 2 \Rightarrow \forall t \in T: \ 1+t < x \Rightarrow \forall t \in T: x \notin (t, t+1) \Rightarrow \forall t \in T: \ x \notin A_t.$

$$\boxed{\bigcup_{t \in T} A_t = (0,2)}$$

c) $T = R^+$, $A_t = (1 - \frac{1}{t}, 2 + \frac{3}{t})$

1) Najdeme $\bigcap_{t \in T} A_t$

$\forall x \in R \Rightarrow \exists t = -4 \in T ; A_t = (\frac{5}{4}, \frac{5}{4}) \Rightarrow \exists t \in T : A_t = \emptyset$

$$\boxed{\bigcap_{t \in T} A_t = \emptyset}$$

2) Najdeme $\bigcup_{t \in T} A_t$

$\forall x \in R \Rightarrow \exists t \in T ; t = \frac{1}{|x|+2} > 0 \Rightarrow \exists t \in T ; A_t = (1 - |x| - 2, 2 + 3|x| + 6) \Rightarrow$

$-|x| - 1 < x < 3|x| + 8 \xRightarrow{\exists t \in T :} x \in A_t .$

$$\boxed{\bigcup_{t \in T} A_t = R.}$$

d) $T = (0, 2\rangle$, $A_t = (1 - \frac{1}{t}, 2 + \frac{3}{t})$

1) Najdeme $\bigcap_{t \in T} A_t$

$\forall x, y \in (0, 2\rangle , x, y \in R ; x > y \Rightarrow \frac{1}{x} < \frac{1}{y} \Rightarrow 1 - \frac{1}{y} < 1 - \frac{1}{x} < 2 + \frac{3}{x} < 2 + \frac{3}{y} \Rightarrow$

$A_x \subset A_y \Rightarrow \bigcap_{t \in T} A_t = A_2$

$$\boxed{\bigcap_{t \in T} A_t = (0{,}5 ; 3{,}5).}$$

2) Najdeme $\bigcup_{t \in T} A_t$

$\forall x \in R \Rightarrow \exists t \in T ; t = \frac{1}{|x|+2} \wedge 0 < t \leq \frac{1}{2} \Rightarrow \exists t \in T ; A_t = (1 - |x| - 2, 2 + 3|x| + 6) \Rightarrow$

$-|x| - 1 < x < 3|x| + 8 \Rightarrow \exists t \in T : x \in A_t .$

$$\boxed{\bigcup_{t \in T} A_t = R}$$

e) $T = (0,1)$, $A_t = \left(1 - \frac{1}{1-t}, 2 + \frac{1}{t}\right)$

① Najdeme $\bigcap_{t \in T} A_t$

1) $\forall x \in \mathbb{R};\ x \in \langle 0,3\rangle \overset{1.}{\Rightarrow} \forall t \in T;\ 0 < 1-t < 1 \Rightarrow \forall t \in T;\ \frac{1}{1-t} > 1 \Rightarrow$

$\forall t \in T;\ 1 - \frac{1}{1-t} < 0 \Rightarrow \forall t \in T;\ x > 1 - \frac{1}{1-t}.$

$\overset{2.}{\Rightarrow} \forall t \in T;\ \frac{1}{t} > 1 \Rightarrow \forall t \in T;\ 2 + \frac{1}{t} > 3 \Rightarrow \forall t \in T;\ x < 2 + \frac{1}{t}$

$\left.\begin{matrix}1\\2\end{matrix}\right\} \Rightarrow \forall t \in T;\ x \in A_t.$

2) $\forall x, \alpha \in \mathbb{R};\ x = 3 + \alpha \wedge \alpha > 0 \Rightarrow \exists t \in T;\ t = 1 - \frac{\alpha}{1+\alpha} \Rightarrow \exists t \in T;\ A_t = \left(1 - \frac{1}{1-t}, 2 + \frac{1}{t}\right) \Rightarrow$

$\Rightarrow \exists t \in T;\ A_t = \left(1 - \frac{1}{1 - 1 + \frac{\alpha}{1+\alpha}}, 2 + \frac{1}{1 - \frac{\alpha}{1+\alpha}}\right) \Rightarrow \exists t \in T;\ A_t = \left(1 - \frac{1+\alpha}{\alpha}, 2 + 1 + \alpha\right) \Rightarrow$

$\exists t \in T;\ A_t = \left(-\frac{1}{\alpha}, 3 + \alpha\right) \Rightarrow \exists t \in T;\ x \notin A_t.$

3) $\forall x, \alpha \in \mathbb{R};\ x = 0 - \alpha \wedge \alpha > 0 \Rightarrow \exists t \in T;\ t = \frac{\alpha}{1+\alpha} \Rightarrow \exists t \in T;$

$A_t = \left(1 - \frac{1}{1 - \frac{\alpha}{1+\alpha}}, 2 + \frac{1}{\frac{\alpha}{1+\alpha}}\right) \Rightarrow \exists t \in T;\ A_t = \left(1 - 1 - \alpha, 2 + \frac{1+\alpha}{\alpha}\right) \Rightarrow$

$\exists t \in T;\ A_t = \left(-\alpha, 3 + \frac{1}{\alpha}\right) \Rightarrow \exists t \in T;\ x \notin A_t.$

$$\boxed{\bigcap_{t \in T} A_t = \langle 0,3\rangle}$$

② Najdeme $\bigcup_{t \in T} A_t$

1) $\forall x \in \mathbb{R};\ x > 0 \Rightarrow \exists t \in T;\ t = \frac{1}{x+1} \Rightarrow \exists t \in T;\ A_t = \left(1 - \frac{1}{1 - \frac{1}{x+1}}, 2 + \frac{1}{\frac{1}{x+1}}\right) \Rightarrow$

$\exists t \in T;\ A_t = \left(1 - \frac{x+1}{x}, 2 + x + 1\right) \Rightarrow \exists t \in T;\ A_t = \left(-\frac{1}{x}, 3 + x\right) \Rightarrow \exists t \in T;\ x \in A_t.$

2) $\forall x \in \mathbb{R};\ x \leq 0 \Rightarrow \exists t \in T;\ t = 1 - \frac{1}{2-x} \Rightarrow \exists t \in T;\ A_t = \left(1 - \frac{1}{1 - (1 - \frac{1}{2-x})}, 2 + \frac{1}{1 - \frac{1}{2-x}}\right) \Rightarrow$

$\exists t \in T;\ A_t = \left(1 - 2 + x, 2 + \frac{2-x}{1-x}\right) \Rightarrow \exists t \in T;\ A_t = \left(x - 1, 3 + \frac{1}{1-x}\right) \Rightarrow \exists t \in T;\ x \in A_t.$

$$\boxed{\bigcup_{t \in T} A_t = \mathbb{R}}$$

f) $T = (0,1)$, $A_t = \langle -\frac{1}{t}, \frac{1}{t} \rangle$

① Najdeme $\bigcap_{t\in T} A_t$

1) $\forall x \in \mathbb{R};\ x \in \langle -1, 1\rangle \Rightarrow \forall t \in T;\ \frac{1}{t} > 1 \wedge -\frac{1}{t} < -1 \Rightarrow \forall t \in T;\ -\frac{1}{t} < x \wedge$

$\frac{1}{t} > x \Rightarrow \forall t \in T;\ x \in A_t.$

2) $\forall x, \alpha \in \mathbb{R};\ (x = 1+\alpha \vee x = -1-\alpha) \wedge \alpha > 0 \Rightarrow \exists t \in T;\ t = \frac{1}{1+\frac{\alpha}{2}} \Rightarrow$

$\exists t \in T;\ A_t = (-1-\frac{\alpha}{2}, 1+\frac{\alpha}{2}) \Rightarrow \exists t \in T;\ x \notin A_t.$

$\boxed{\bigcap_{t\in T} A_t = \langle -1, 1\rangle}$

② Najdeme $\bigcup_{t\in T} A_t$

$\forall x \in \mathbb{R} \Rightarrow \exists t \in T;\ t = \frac{1}{|x|+1} \Rightarrow \exists t \in T;\ A_t = (-|x|-1, |x|+1) \Rightarrow \exists t \in T;\ x \in A_t.$

$\boxed{\bigcup_{t\in T} A_t = \mathbb{R}}$

g) $T = (0,1)$, $A_t = (2-\frac{1}{t}, 4+\frac{2}{t})$

① Najdeme $\bigcap_{t\in T} A_t$

1) $\forall x \in \mathbb{R};\ x \in \langle 1, 6\rangle \Rightarrow \forall t \in T;\ -\frac{1}{t} < -1 \wedge \frac{1}{t} > 1 \Rightarrow \forall t \in T;\ 2-\frac{1}{t} < 1 \wedge$

$4+\frac{2}{t} > 6 \Rightarrow \forall t \in T;\ x \in A_t.$

2) $\forall x, \alpha \in \mathbb{R};\ (x = 1-\alpha \vee x = 6+\alpha) \wedge \alpha > 0 \Rightarrow \exists t \in T;\ t = \frac{1}{1+\frac{\alpha}{4}} \Rightarrow \exists t \in T;$

$A_t = (2 - \frac{1}{\frac{1}{1+\frac{\alpha}{4}}}, 4 + \frac{2}{\frac{1}{1+\frac{\alpha}{4}}}) \Rightarrow \exists t \in T;\ A_t = (1-\frac{\alpha}{4}, 6+\frac{\alpha}{2}) \Rightarrow \exists t \in T;\ x \notin A_t.$

$\boxed{\bigcap_{t\in T} A_t = \langle 1, 6\rangle}$

② Najdeme $\bigcup_{t\in T} A_t$

$\forall x \in \mathbb{R} \Rightarrow \exists t \in T;\ t = \frac{1}{|x|+3} \Rightarrow \exists t \in T;\ A_t = (2-|x|-3, 4+2|x|+6) \Rightarrow \exists t \in T;$

$A_t = (-1-|x|, 10+2|x|) \Rightarrow \exists t \in T;\ x \in A_t$

$\boxed{\bigcup_{t\in T} A_t = \mathbb{R}}$