

## MATH 220.201 CLASS 13 QUESTIONS

For each of the following relations from  $S$  to itself, determine whether or not it is an equivalence relation.

(1)  $S = \mathbb{Z}$ ;  $a \sim b$  if  $a \mid b$ .

(2)  $S = \mathbb{Z}$ ;  $a \sim b$  if either  $a \nmid b$  or  $b \nmid a$ .

(3)  $S = \mathbb{Z}$ ;  $a \sim b$  if  $a \equiv b \pmod{6}$ .

(4)  $S = \mathbb{N}$ ;  $a \sim b$  if  $a$  and  $b$  have a common prime factor.

(5)  $S = \mathbb{R}$ ;  $a \sim b$  if  $b - a \in \mathbb{Z}$ .

(6)  $S = \mathbb{R}$ ;  $a \sim b$  if  $|b - a| < 1$ .

(7)  $S = \mathbb{R}$ ;  $a \sim b$  if  $\sqrt{e^a + 2} = \sqrt{e^b + 2}$ .

(8)  $S = \mathbb{Z}$ ;  $a \sim b$  if  $3a + 5b$  is even.

(9)  $S = \mathbb{Z}$ ;  $a \sim b$  if  $a + b$  is odd.

(10)  $S$  is the set of lines in the plane;  $\ell_1 \sim \ell_2$  if either  $\ell_1 = \ell_2$  or  $\ell_1 \parallel \ell_2$ .<sup>1</sup>

(11)  $S$  is the set of lines in the plane;  $\ell_1 \sim \ell_2$  if either  $\ell_1 = \ell_2$  or  $\ell_1 \perp \ell_2$ .<sup>2</sup>

(12)  $S$  is the set of lines in the plane;  $\ell_1 \sim \ell_2$  if  $\ell_1 = \ell_2$  or  $\ell_1 \perp \ell_2$  or  $\ell_1 \parallel \ell_2$ .

(13)  $S$  is the set of lines in  $\mathbb{R}^3$  containing  $(0, 0, 0)$ ;  $\ell_1 \sim \ell_2$  if  $\ell_1 = \ell_2$  or  $\ell_1 \perp \ell_2$ .

---

<sup>1</sup> $\ell_1 \parallel \ell_2$  means ' $\ell_1$  is parallel to  $\ell_2$ '.

<sup>2</sup> $\ell_1 \perp \ell_2$  means ' $\ell_1$  is orthogonal (perpendicular) to  $\ell_2$ '.