

1  $\forall r$ , if  $3r^2 + 5r - 1$  is irrational then  $r$  is irrational

a. There exists a number  $r$  such that if  $3r^2 + 5r - 1$  is irrational then  $r$  is rational.

$r = \frac{a}{b}$  where  $a$  is an integer and  $b$  is nonzero integer

$$3\left(\frac{a}{b}\right)^2 + 5\left(\frac{a}{b}\right) - 1$$

$$= \frac{3a^2}{b^2} + \frac{5a}{b} - 1$$

Since the statement are ratios of integers where  $b$  is nonzero,  $\frac{a^2}{b^2}$  is also a ratio of integers and therefore, rational.

The statement can not be both irrational and rational which is a contradiction.

b. For every number  $r$  such that if  $r$  is irrational then  $3r^2 + 5r - 1$  is rational

$r = \sqrt{a}$  where  $a$  is a non zero integer

$$3(\sqrt{a})^2 + 5(\sqrt{a}) - 1$$

$$3a + 5\sqrt{a} - 1$$

Since the statement still contains a  $\sqrt{a}$  in it, the statement is still irrational.

2 Suppose  $3\sqrt{2} - 5$  is rational

$$3\sqrt{2} - 5 = \frac{a}{b} \quad (b \neq 0)$$

$$3\sqrt{2} - 5 = \frac{a}{b} \quad \text{where } b \neq 0$$

$$3\sqrt{2} = \left(\frac{a}{b} + 5\right)$$

$$\sqrt{2} = \frac{a + 5b}{3b}$$

Since  $\sqrt{2}$  is equal to a ratio of integer,  $\sqrt{2}$  is rational. This is a contradiction as  $\sqrt{2}$  is irrational.

3

a. 4131 and 2431

$$4131 / 2431 = \text{Remainder of } 1700$$

$$2431 / 1700 = \text{Remainder of } 731$$

$$1700 / 731 = \text{Remainder of } 238$$

$$731 / 238 = \text{Remainder of } 17$$

$$238 / 17 = \text{Remainder of } 0$$

$$\text{GCD of } 4131 \text{ and } 2431 = 17$$

## CJ Hess

### Paper Homework 3

#### Problem 3 Code

```
Users > cj_hess510 > Desktop > homewor.py > ...  
1  def gcd():  
2      a = 1570  
3      b = 488  
4      r = 488  
5  
6      while (b != 0):  
7          r = a % b  
8          a = b  
9          b = r  
10  
11     print("GCD of %d and %d: %d" % (1570, 488, a))  
12  
13     gcd()
```

#### Problem 3 Input

TERMINAL   PROBLEMS   OUTPUT   DEBUG CONSOLE

```
(base) CJs-MacBook-Pro:~ cj_hess510$ python -u "/Users/cj_hess510/Desktop/homewor.py"  
GCD of 1570 and 488: 2  
(base) CJs-MacBook-Pro:~ cj_hess510$ █
```