

## MATH 111 SOLUTIONS TO HW2

18. (a) The negation of “All mathematics problems are easy” is “Some mathematics problems are not easy” (or, equivalently, “Not all mathematics problems are easy”).
- (b) The negation of “Some numbers are not natural numbers” is “All numbers are natural numbers”.
19. (a) If a bird has a red head, then it is a Western Tanager.
- (b) If a bird does not have a red head, then it is not a Western Tanager.
- (c) If a bird is not a Western Tanager, then it does not have a red head.
20. By *modus ponens*, one valid conclusion for this argument is: Rose makes fewer computation errors than one who does not use a calculator.

Dr. Wonderful’s birthday trick.

Let  $m$  and  $d$  represent the month and day of someone’s birthday. We follow through the steps of the trick, simplifying the answers as we go along.

- Step 1. The birthday month is  $m$ .
- Step 2.  $m$  times 5 is  $5m$ .
- Step 3.  $5m$  plus 20 is  $5m + 20$ .
- Step 4.  $5m + 20$  times 4 is  $4 \cdot (5m + 20) = 4 \cdot 5m + 4 \cdot 20 = 20m + 80$ , by the distributive law of multiplication.
- Step 5.  $20m + 80$  minus 7 is  $20m + 80 - 7 = 20m + 73$ .
- Step 6.  $20m + 73$  times 5 is  $5 \cdot (20m + 73) = 100m + 365$ .
- Step 7.  $100m + 365$  plus  $d$  is  $100m + 365 + d$ .
- Step 8.  $100m + 365 + d$  minus 365 is  $100m + d$

So the display of the calculator reads  $100m + d$ . But  $100m$  is the birth month followed by 00. Adding  $d$  changes 00 to the birth day (e.g. 08, if the day is the 8th), so the calculator shows the month followed by the day. Examples: if  $m = 3$  and  $d = 8$ , then the calculator reads 308. If  $m = 9$  and  $d = 12$ , the calculator reads 912. If  $m = 12$  and  $d = 23$ , the calculator reads 1223.