

ALGEBRA
January 17, 2007

1. The equation $2x^4 - 3x^3 - 14x^2 - 22x - 8 = 0$ has two real and two complex solutions. What is the product of the two complex solutions?

- (a) -1
- (b) 1
- (c) 2
- (d) 5
- (e) none of these

2. For positive real numbers x and y define $x \star y = \frac{x+y}{xy}$. Which of the following are true for all positive numbers x, y and z ?

- (i) $1 \star x = x$
 - (ii) $x \star y = y \star x$
 - (iii) $(x \star y) \star z = x \star (y \star z)$
 - (iv) $(x + y) \star z = x \star z + x \star z$
- (a) all are true
 - (b) none are true
 - (c) only (ii) is true
 - (d) only (i) and (ii) are true
 - (e) only (ii) and (iii) are true

3. Adam, Bonnie, Connie, Dan and Elly went to high school together, although Adam dropped out before graduation. Eventually their professions became actuary, base fiddle player, computer programmer, clothes designer, and electrical engineer, although not necessarily respectively. Connie, and the engineer, and the actuary, frequently play bridge together. Elly joins them sometimes after game to go to movies. The base player left the state and never had contact with any of the others again. Dan, who knows nothing about music dates the computer programmer. The clothes designer, who doesn't play cards, is a widow. The electrical engineer is married to her college sweetheart. Who is the engineer?

- (a) Adam
- (b) Bonnie
- (c) Connie
- (d) Dan
- (e) Ellye

4. The last decimal digit of 2004^{2004} is

- (a) 0
- (b) 2
- (c) 4
- (d) 6
- (e) 8

5. The sum of the solutions to the equation $\sqrt{6x - 2} - \sqrt{4x - 3} = 1$ is:

- (a) 4
- (b) 3
- (c) -3
- (d) -4
- (e) none of these

6. Five friends Alex, Bill, Charlie, Daniel, and Eddy all own different brands of cars. Their cars are a Ford, a Buick, a Honda, an Audi and a Mercedes. One week they decided to try each others' cars and they traded cars every day to try all 5 cars. From Monday through Thursday none drove his own car and on Friday everybody drove his own car.

On Monday Daniel drove the Audi. On Tuesday Charlie drove the Mercedes. On Wednesday Charlie drove the Honda and Eddy the Mercedes. On Thursday Alex had the Audi and Daniel had the Buick. What kind of car does Bill have?

- (a) Ford
- (b) Buick
- (c) Honda
- (d) Audi
- (e) Mercedes