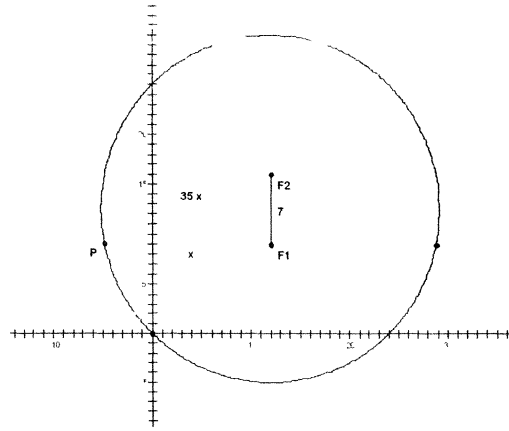


**Team Round:**

- A. Origin is 15 and 20 units from foci so sum of distances is 35. If  $P=(w, 9)$  then  $\triangle PF_1F_2$  is a right triangle with legs of 7 and  $x$  and hypotenuse  $(35-x)$ .  
Pythagorean thm gives  $x = 16.8$  So  $a = 12 \pm 16.8$ .



- B. Let  $x = 3b+1$ . Factoring  $4x^4 + 3x^2 + 1 = 4x^4 + 4x^2 + 1 - x^2 = (2x^2+1)^2 - x^2 = (2x^2 + 1 + x)(2x^2 + 1 - x)$  Replace  $x$  with  $3b+1$  and simplify.
- C.  $2\cos^2(6x) = \sin(12x) = 2\sin(6x)\cos(6x)$  so  $\cos(6x)=0$ ,  $6x=90+180n$ ,  $x=15+30n$  or  $\cos(6x)=\sin(6x)$ ,  $6x=45+180n$ ,  $x=7.5+30n$ .  $2\sin(12y)+2 = \cos^2(12y)=1-\sin^2(12y)$ ,  $\sin^2(12y)+2\sin(12y)+1=0$ ,  $(\sin(12y)+1)^2=0$  so  $\sin(12y)=-1$ ,  $12y=270+360n$ ,  $y=22.5+30n$ . Complimentary pairs come from  $x=7.5+30n$ ,  $y=22.5+30n$ .
- D. Outer rectangle:  $(10+2x)(16+2x)$ ; middle band:  $160 - (10-2x)(16-2x)=52x-4x^2$   
Solve  $3(52x - 4x^2) = 160+52x+4x^2$  or  $16x^2 - 104x + 160=0$  or  $8(x-4)(2x-5)=0$  If  $x=4$ , inner is  $2 \times 8 = 16$ ; if  $x=2.5$ , inner is  $5 \times 11 = 55$ .
- E.  $AF:AB = AB:AC$  so  $AF = 27/4$ .  $FC = AB - AF = 21/4$ .  
 $\text{Area}(\triangle DFC) / \text{Area}(\triangle DAF) = FC/AF$ , since they have a common height.
- F. If  $15 + 2(k) = 5 + 6(2k)$  then  $k = 1$  and there was  $15 + 2(1) = \$17$  to spend.  
If  $15 + 2(2n) = 5 + 6(n)$  then  $n = 5$  and there was  $5 + 6(5) = \$35$  to spend. Total was  $35+17 = \$52$ .