Hustle Algebra II Solutions 2012 MAQ National Convention

1. **13** Set up a system: *a* + *b* = 38; *a* + *c* = 40: *b* + *c* = 52. Using substitution and solving, we get *a* = 13, *b* = 25, and *c* = 27. Smallest number is **13**.
2. There are 24 possibilities with 4 children, one of which is all girls. So there are only 15 possibilities for the Davis family. Of those 15, four are 1 girl and 3 boys, so .



1. ; setting exponents equal: -3*x* +12 = 8*x* + 4, so *x* =



1. **10** The cone has volume: , so **10**.



1. **7** Using properties of logs, we get = **7.**



1. **82**  Let *t*  and *u* represent the ten’s digit and unit’s digit of the original number, respectively. Then *t* + *u =* 10 and *t* -2 + (*u* +2)(10) = 10*t* + *u* -36. Solving the system gives us *u* = 2 and *t* = 8, so the original number is **82**.
2. **6** Factor first: . Cancel out the (*x* –*y*) on both sides, and substitute 6 for (*x* + *y*). We now have . Now take *x* + *y* = 6 and square both sides; we get . Combine the two equations with subtraction, and *xy* = **6**.



1. ****  The term is: ;  = ****.
2. **** The pattern of this sequence is: ; the missing terms therefore are 25, 6, and 1/8; their sum is ****.
3. **13** Solve as a linear system: 3*x* – 2*y* = -16 and 4*x* + 5*y* = 17. The solution is *x* = -2, *y* = 5, so *x* + *y* – *xy*  = **13.**
4. **1,344** This is equal to =. The products and sum are: 24 + 120 + 360 + 840 = **1,344.**
5. **1** Set up as a disjunction: , ⇒. The only non-negative integral solution is 0, so the answer to the question is **one**.
6. **** From ¼ to ¾ is a distance of ½ . Two-thirds of ½ is 1/3 , which added to ¼ = **.**
7. **10** The two conjugate roots must be 2 + 3*i* and 2 – 3*i*. Using sum and product of roots, the sum = 4 = -b/a, and product = 13 = c/a, so *a* = 1, *b* = -4, and *c* = 13; their sum = **10.**
8. **{ -1, 0}**  Rewrite terms: ; let *a* =  and *b* = . We now have , which factors to (3*a* – 2*b*)(*a* – *b*) = 0. So 3*a* = 2*b* and *a* = *b*. Substituting back in, so *x* = -1; the other case is , so *x* = 0. **{ -1, 0}.**
9. ***y* = 7/2 *x*+35/2** The given line has slope = -2/7; the perpendicular slope = 7/2. Using point-slope form, *y* – 0 = (7/2)(*x* +5), which in slope-intercept form is ***y* = 7/2 *x*+35/2.**
10. **** Set up:  (Girls ⋅ Boys⋅Teachers)/ total possibilities. This simplifies to , which = **.**
11. **10** Find the intersection points of the 3 lines by solving as systems. This gives us points (0, 2), (2, 0) , and (4, 3). Evaluating each point in the function: *f* (2, 0) = -6, *f* (0, 2) = 10, *f* (4,3 ) = 3. The maximum value is **10**.
12. **** The equation represents an ellipse with center (1, -3) and *a* = 4, *b* = . Area of ellipse = *ab*π = **.**  The line *x* = 1 bisects the ellipse, the resulting area is **.**
13. **3** This is the circle . The center is (4, -3); the radius to (-1, 2) has slope *m* = -1. The slope of the tangent is 1, the equation of the tangent is *y* = *x* + **3**.
14. **4** We only need to look at powers of *b*: . The power of b is **4.**
15. The volume of the given cone is . For both cones, the ratio of height to radius is *h*:*r* = 4:1, so *h* = 4*r*. At 1/6 full the volume is 48π, so  which gives us *r* = **.** Height = 4*r* = **.**
16. **32*i***  Simplifying we get: *i2 ⋅ i*1 *⋅ i3 ⋅ 1 ⋅ i*2 *⋅* 32(*i*)= -1*⋅ i ⋅ -i ⋅* 1 *⋅ 32i* = **32*i***
17. **(-2, -10)** First factor: . This function is undefined at *x* = -2, however after reducing, we have *f* (*x*) = 3*x* – 4, so we have the point **(-2, -10).**
18. **18** Factoring, we get (12*x* – 5)(3*x* + 8): 12 + -5 + 3 + 8 = **18.**