

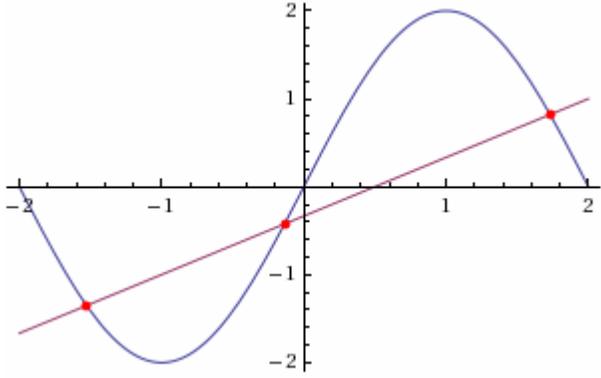


Rocket City Math League

Apollo Test Solutions

2009-2010
Round 1

1. Since the pages are printed front to back, whenever an even numbered page is ripped out, the odd numbered paged is also ripped out. This means that if all of the even numbered pages are ripped out, then all of the odd numbered pages are also ripped out, leaving 0 pages in the book.	0																																																	
2. It takes Fleur 17 hours to travel 40137 kilometers. To get the speed of flight, divide the distance (40137 km) by the time it took to travel that distance (17 hours). So, $40137 \div 17 = 2361$. So Fleur was traveling 2361 km per hour.	2361																																																	
3. Since Commander Jack can only chose one of each type of crew member, multiply all the types of crew members: 1 Commander \cdot 2 Captains \cdot 3 Pilots \cdot 4 Navigators \cdot 15 Medical Officials. So, $1 \cdot 2 \cdot 3 \cdot 4 \cdot 15 = 360$ teams.	360																																																	
4. First subtract Savannah's feet from the total. $163 - 4 = 159$. Then to find the minimum number of chicken in the field, find the maximum number of sheep and subtract that from the total. $159 \div 7 = 22.71\dots$ then $7 \cdot 22 = 153$, so $159 - 153 = 6$. Since each chicken has 2 feet, there has to be a minimum of one chicken in the field.	1																																																	
5. Take 30210 and multiply each digit by the corresponding base and exponent: $3(4^4) + 0(4^3) + 2(4^2) + 1(4^1) + 0(4^0) = 768 + 0 + 32 + 4 = 804$.	(Base) 4																																																	
6. First factor the polynomial: $f(x) = x^3 - 16x^2 + 73x - 90 = (x - 2)(x - 5)(x - 9)$. Since it is given that the gun nullified more than 6 black holes, then the number of black holes nullified has to be 9 from the possible 2, 5, and 9.	9																																																	
7. Since there were 8 gallons bought, the station charges $(1 - i)^8 = 16$ asters per gallon. Since there are 8 gallons of gas being purchased, then this costs 16 asters/gallon \cdot 8 gallons = 128 asters.	128																																																	
8. A grid has been created below to represent the possible ways that Savannah could get to the Holy Dog Bowl. The V represents the location of Viadd, and the X's represent the points that Savannah cannot go through without being caught. Each number represents the number of ways that Savannah can reach that point (the numbers are written down and to the right of the point that they represent). Each number is found by summing the two numbers for the possible ways to reach the two prior points. For example, the point (3,2) has a number 10, because there are 6 ways to get to (2,2) and 4 ways to get to (3,1) and $6+4=10$. Continue the pattern throughout the grid (avoiding Viadd) and you get the grid below. So the answer is 185.	185																																																	
<table border="1" style="display: inline-table; border-collapse: collapse; margin-bottom: 5px;"> <tbody> <tr><td>1</td><td>7</td><td>28</td><td>64</td><td>100</td><td>136</td><td>185</td></tr> <tr><td>1</td><td>6</td><td>21</td><td>36</td><td>36</td><td>36</td><td>49</td></tr> <tr><td>1</td><td>5</td><td>15</td><td>15</td><td>X</td><td>0</td><td>13</td></tr> <tr><td>1</td><td>4</td><td>10</td><td>X</td><td>V</td><td>X</td><td>13</td></tr> <tr><td>1</td><td>3</td><td>6</td><td>10</td><td>X</td><td>6</td><td>13</td></tr> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>Start</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> </tbody> </table>	1	7	28	64	100	136	185	1	6	21	36	36	36	49	1	5	15	15	X	0	13	1	4	10	X	V	X	13	1	3	6	10	X	6	13	1	2	3	4	5	6	7	Start	1	1	1	1	1	1	
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Start	1	1	1	1	1	1																																												
9. The polynomial $x^4 - 14x^3 + 71x^2 - 154x + 120$ factors out to $(x - 2)(x - 3)(x - 4)(x - 5)$. For Savannah to escape, she has to punch in 2, 3, 4, and 5 in any order.	2, 3, 4, 5																																																	
10. Multiply the number of flavors (5) by the number of shapes (4) to find that there are 20 possible combinations of flavors and shapes. This means, that for each possible combination of textures, there are 20 possible treats. Now calculate the number of possible texture combinations and multiply that by 20. There are 5 ways to choose 1 texture. If you want 2 textures, then there are ${}^5C_2 - 1 = \frac{5!}{2!3!} - 1 = \frac{5 \cdot 4}{2} - 1 = 10 - 1 = 9$ combinations of 2 textures, since all combinations of 2 textures will work except for the combination of shaken and stirred. Then for 3 textures there are	460																																																	

<p>${}_5C_3 - 3 = 10 - 3 = 7$ possible combinations of textures because any combination of 3 works, except for the 3 combinations where shaken and stirred are used together with one of the other 3 textures. Then to have 4 textures there are 2 possible combinations of textures because shaken and stirred cannot be used together, so either shaken or stirred has to be the only texture not used, hence, 2 possibilities.</p> <p>$5 + 9 + 7 + 2 = 23$ different ways for the treat to be textured.</p> <p>Each of these ways has 20 combinations of flavors and shapes that it can be paired with, so there are $20 * 23 = 460$ total possible types of treats.</p>	
<p>11. The formula for an area of an ellipse is $ab\pi$, where a is a half of the major axis and b is a half of the minor axis. So $3 \cdot 5 \cdot \pi = 15\pi$.</p>	<p>15π</p>
<p>12. Graph both equations ($y = 2 \sin\left(\frac{x\pi}{2}\right)$ and $y = \frac{2}{3}x - \frac{1}{3}$). Then count to see there are 3 intersection points.</p> <p>The 3 intersection points occur roughly at $x = -1.53, -0.14, 1.73$</p> <p>The graph looks like</p>  <p style="font-size: small;">Wolfram Alpha LLC. 2010. Wolfram Alpha. http://www.wolframalpha.com/input/?i=2sin(pi*x/2)-1/3 (access January 18, 2010).</p>	<p>3</p>

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