

## Holiday Fun with 2006

- 1) Add  $1235 + 771$ .
- 2) Subtract  $3333 - 1327$ .
- 3) Multiply  $860 \times 7$ .
- 4) Divide 26078 by 13.
- 5) Which five of these seven numbers add up to 2006: 37, 42, 108, 345, 567, 765, 944.
- 6) Write 2006 as the sum of two prime numbers.
- 7) Write 2006 as the sum of three triangular numbers.
- 8) Write 2006 as the sum of four square numbers.
- 9) What is the prime factorization of 2006?
- 10) How many steps will it take for 2006 to reach 1 in the  $3n + 1$  game? (Reminder: if  $n$  is even, divide by 2; if  $n$  is odd, multiply by 3 and add 1.)
- 11) What are the solutions to  $x^2 - 2025x + 38,114 = 0$ ?
- 12) Write down the number of months in a year. Multiply by 7. Multiply by 11. Multiply by 13. Subtract the 100<sup>th</sup> square number. Subtract the first perfect number. What have you got?

On January 17, 2006, people around the world will be celebrating the 300<sup>th</sup> birthday of Benjamin Franklin. This unusual man is usually described in an unusually long list, such as "printer, writer, scientist, inventor, civic leader, revolutionary and international diplomat." (quotation from <http://www.benfranklin300.org/>) He was also--to add to the list--an elementary school flunk-out, a teen-age runaway, and an amazing swimmer. Ben began school when he was eight, but he failed arithmetic twice, and his father took him out of school at age ten. At age twelve he was apprenticed to his older brother James, a printer. (Later, at age sixteen, he taught himself arithmetic with the help of a book.) At age seventeen, after numerous fights with his brother, he ran away from Boston to Philadelphia. As a young man he occasionally amused himself by making up magic squares. A friend once talked to him about magic squares, and Ben showed him an  $8 \times 8$  one he had created.

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13) See if you can use the numbers from 1 to 64 to complete Ben Franklin's 8 x 8 square. (See other page.) Every row and column adds up to 260. So do the bent diagonals and the four corner squares plus the four middle squares! Can you figure out why the magic sum must be 260?

Next this same friend showed Franklin a 16 x 16 magic square in an old book by Stifelius. "Not willing to be outdone by Mr. Stifelius, even in the size of my square, I went home and made that evening the following magical square of 16 x 16." Ben was very pleased with this magic square and playfully asserted: "I make no question but you will readily allow this square of 16 to be the most magically magical of any magic square ever made by any magician." (Quotes from <http://www.mathpages.com/home/kmath155.htm>)

14) See if you can complete Ben Franklin's 16 x 16 magic square. (See other page.) Use the numbers from 1 to 256. Since this is more of a challenge, we'll give you extra time to work on it--fifty years. Give your final copy to Richard or Dave on or before January 1, 2056. The magic sum for this magic square is 2056, and every row and column add to that number. So do the bent diagonals. So do the 16 entries in any 4 x 4 square anywhere in the bigger square!

While in England in 1726, Ben went on an excursion on the Thames River. He wrote: "At the request of the company, I stripped and leaped in the river, and swam from near Chelsea to Blackfriars (3 1/2 miles) performing on the way many feats of activity, both upon and under water, that surprised and pleased those to whom they were novelties. I had from a child been ever delighted with this exercise, had studied and practiced all Thevenot's motions and positions, added some of my own, aiming at graceful and easy as well as useful. All these I took occasion of exhibiting to the company, and was much flattered by their admiration." (Quotation from <http://www.ishof.org/68bfranklin.html>)

15) Swim three and a half miles!

16) Use the numbers 1 through 12 to complete the magic star on the other page, created by Mutsumi Suzuki of Japan. (<http://mathforum.org/alejandre/magic.star/msuzuki1.html>) Each line of four must add up to the magic sum of 26. (Can you explain why 26 is the magic sum?)

17) Learn more about magic squares, Benjamin Franklin and magic stars!

18) Have fun! And have a happy, healthy 2006!

Reminders:

The first 50 primes:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37,  
41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83,  
89, 97, 101, 103, 107, 109, 113, 127, 131,  
137, 139, 149, 151, 157, 163, 167, 173, 179,  
181, 191, 193, 197, 199, 211, 223, 227,  
229

The first 62 triangular numbers:

1, 3, 6, 10, 15, 21, 28, 36, 45, 55, 66, 78, 91, 105,  
120, 136, 153, 171, 190, 210, 231, 253, 276, 300, 325,  
351, 378, 406, 435, 465, 496, 528, 561, 595, 630, 666,  
703, 741, 780, 820, 861, 903, 946, 990, 1035, 1081,  
1128, 1176, 1225, 1275, 1326, 1378, 1431, 1485, 1540,  
1596, 1653, 1711, 1770, 1830, 1891,  
1953

The first 44 square numbers:

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169,  
196, 225, 256, 289, 324, 361, 400, 441, 484, 529,  
576, 625, 676, 729, 784, 841, 900, 961, 1024, 1089,  
1156, 1225, 1296, 1369, 1444, 1521, 1600, 1681, 1764, 1849,  
1936

52	61	4	13	20	29	36	45
14	3	62	51	46	35	30	19
53	60	5	12	21	28	37	44
11	6	59	54	43	38	27	22
55	58	7	10	23	26	39	42
9	8	57	56	41	40	25	24
50	63	2	15	18	31	34	47
16	1	64	49	48	33	32	17

200	217	232	249	8	25	40	57	72	89	104	121	136	153	168	185
58	39	26	7	250	231	218	199	186	167	154	135	122	103	90	71
198	219	230	251	6	27	38	59	70	91	102	123	134	155	166	187
60	37	28	5	252	229	220	197	188	165	156	133	124	101	92	69
201	216	233	248	9	24	41	56	73	88	105	120	137	152	169	184
55	42	23	10	247	234	215	202	183	170	151	138	119	106	87	74
203	214	235	246	11	22	43	54	75	86	107	118	139	150	171	182
53	44	21	12	245	236	213	204	181	172	149	140	117	108	85	76
205	212	237	244	13	20	45	52	77	84	109	116	141	148	173	180
51	46	19	14	243	238	211	206	179	174	147	142	115	110	83	78
207	210	239	242	15	18	47	50	79	82	111	114	143	146	175	178
49	48	17	16	241	240	209	208	177	176	145	144	113	112	81	80
196	221	228	253	4	29	36	61	68	93	100	125	132	157	164	189
62	35	30	3	254	227	222	195	190	163	158	131	126	99	94	67
194	223	226	255	2	31	34	63	66	95	98	127	130	159	162	191
64	33	32	1	256	225	224	193	192	161	160	129	128	97	96	65

200	217	232	249	8	25	40	57	72	89	104	121	136	153	168	185
58	39	26	7	250	231	218	199	186	167	154	135	122	103	90	71
198	219	230	251	6	27	38	59	70	91	102	123	134	155	166	187
60	37	28	5	252	229	220	197	188	165	156	133	124	101	92	69
201	216	233	248	9	24	41	56	73	88	105	120	137	152	169	184
55	42	23	10	247	234	215	202	183	170	151	138	119	106	87	74
203	214	235	246	11	22	43	54	75	86	107	118	139	150	171	182
53	44	21	12	245	236	213	204	181	172	149	140	117	108	85	76
205	212	237	244	13	20	45	52	77	84	109	116	141	148	173	180
51	46	19	14	243	238	211	206	179	174	147	142	115	110	83	78
207	210	239	242	15	18	47	50	79	82	111	114	143	146	175	178
49	48	17	16	241	240	209	208	177	176	145	144	113	112	81	80
196	221	228	253	4	29	36	61	68	93	100	125	132	157	164	189
62	35	30	3	254	227	222	195	190	163	158	131	126	99	94	67
194	223	226	255	2	31	34	63	66	95	98	127	130	159	162	191
64	33	32	1	256	225	224	193	192	161	160	129	128	97	96	65

1

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2

10

9

11

8

12

4

3

7

6

