C 1. M has equation $-ax + by = c$, and N has equation $ax - by = c$. The x-intercepts are $-c/a$ and c/a, the y-intercepts are c/b and $-c/b$, and the slopes are both a/b, so only C is true.

A 2. One penny, nickel, dime, and quarter are worth 41¢. The largest multiple of 41 less than 200 is 164.

B 3. By the Division Algorithm, $P(x) = Q(x)(x - 2)^2 + (3x - 3)$, where $Q(x)$ is the quotient. Then $(x - 1)P(x) = Q(x)(x - 1)(x - 2)^2 + (x - 1)(3x - 3)$. Thus the new remainder is $3x^2 - 6x + 3$.

B 4. Since $f(3) = 7$, $f(7) = 19$, and $f(19) = 55$, the answer is B.

A 5. By the Remainder Theorem, the remainder is $(-2)^3 - 2(-2)^2 + 4$, or -12.

B 6. For p prime and positive solutions, the quadratic must factor into $(x - 1)(x - p)$, so that $k = -(p + 1)$. Thus the sum of k and p is -1.

E 7. The number 3185 factors into (5)(7)(7)(13). To make it a perfect cube, multiply by 5, 5, 7, 13, and 13.

E 8. The common edge must be a factor of both 24 and 36. Thus the possible dimensions of the box are 1x24x36, 2x12x18, 3x8x12, 4x6x9, 4x6x6, and 2x3x12. All six volumes are different.

C 9. The given fraction equals $1 - \sin t \cos t \cot t = 1 - \cos^2 t = \sin^2 t$.

A 10. Notice that n^2 is at the end of row n, so the middle term of row 40 must be $((39^2 + 1) + 40^2)/2 = 1561$.

C 11. The given inequality has solution $(-\infty,-3]$ ∏ $[6,+\infty)$. But -3 does not satisfy either A or B (because of division by zero), so the answer must be C. Note that the solution of C is $(-\infty, 4 - \sqrt{2}]$ ∏ $[4 + \sqrt{2},+\infty)$.

A 12. Since $128b^3 - 16a^3 = 2(4b - 2a)(16b^2 + 8ab + 4a^2)$, then $2a - 4b = 2(4b - 2a)(16b^2 + 8ab + 4a^2)$, and $-1 = 8(a^2 + 2ab + 4b^2)$, so $a^2 + 2ab + 4b^2 = -1/8$.

B 13. Let s be the side length of square EFGH. Then $s^2 + (s/2)^2 = r^2$, so $r = \frac{\sqrt{5}}{2}s$. Then a side of square ABCD $= 2r/\sqrt{2} = \frac{\sqrt{10}}{2}s$, and the area of ABCD $= a = (5/2)s^2$, so the area of EFGH $= s^2 = (2/5)a$.

D 14. The number of arrangements of AMATYC is $6!/2 = 360$ (division by 2 accounts for the duplicate A's). If the A's are on the ends, there are $4! = 24$ ways to place the remaining 4 letters, and if the A's are together, there are 5 ways to place the A's (consider them as a single object) and 4! ways to place the remaining letters for a total of 120 arrangements. The required probability is $(24 + 120)/360 = 2/5$.

C 15. Factoring 3002 yields 2(19)(79), so the prime factors add to 100. For three primes to add to 100, one must be a 2, and the only other possibilities for 98 are 31 + 67 and 37 + 61.

E 16. Clearly M = 19. To find m, assume the math and English students overlap as little as possible. Since there are 5 students not taking math, the smallest overlap is 17. Then if the history students overlap the 8 math students not taking English and the 5 English students not taking math, there must be 19 - 5 - 8 = 6 history students also taking both math and English. Thus m = 6 and M + m = 25.

E 17. Let x be the distance from the hospital to the meeting point. Then $x/60 = \frac{\sqrt{7.5^2 + (60 \square x)^2}}{15}$ (using time is distance over speed). This becomes $(x - 50)(x - 78) = 0$, whose only valid solution is 50. The boat then travels 12.5 miles for a total for the two vehicles of 62.5 miles.

E 18. Examining the equation AMATYC = MYM^2 shows $316 < \sqrt{100000} \le$ MYM $\le \sqrt{999999} < 999$. A quick check of the numbers 323, 343, 353, etc. shows MYM = 363 and AMATYC = 131769, so T = 7.

A 19. The given conditions mean that $x^2 + ax + b = x^2 - (c + d)x + cd$, and $x^2 + cx + d = x^2 - (a + b)x + ab$. Thus $-a = c + d$, $b = cd$, $-c = a + b$, and $d = ab$. Hence $b = abc$ and $ac = 1$. Also, $a + c + d = 0 = a + b + c$, so $b = d$, which means $c = a = 1$. This means that $b = d = -2$, so $a + b + c + d = -2$.

C 20. After t sec, Al's central angle is 6t/150 rad, while Bob's distance from the silo is 6t. Al first sees Bob when his location is the point of tangency of the line to Bob's position. This forms a right triangle, so that $\cos(\pi - 6t/150) = 150/(150 + 6t)$. This equation is satisfied by $t = 48.0075$.

C 1. Suppose the original value was \$100. A 60% loss reduces it to \$40. An increase of \$60 is 150%.

D 2. The expression $x^4 - 4x^3 - x^2 + 16x - 12 = (x^4 - 4x^3 + 4x^2) - (5x^2 - 16x + 12) = x^2(x - 2)^2 - (5x - 6)(x - 2)$ $= (x - 2)(x^2(x - 2) - 5x + 6) = (x - 2)(x(x - 1)^2 - 6(x - 1)) = (x - 2)(x - 1)(x - 3)(x + 2)$.

A 3. The number of books in the library must be divisible by 4, 13, and 17. Thus the number of books is a multiple of (4)(13)(17) = 884. The only multiple of 884 between 1000 and 2000 is 1768, so the number of biographies or atlases must be 1768/13 + 1768/17 = 136 + 104 = 240.

E 4. The fraction 77/81 = 2/3 + 23/81 = 2/3 + 2/9 + 5/81 = 2/3 + 2/9 + 1/27 + 2/81 = 0.2212.

A 5. $\cos 8t = 2\cos^2 4t - 1 = 2(2\cos^2 2t - 1)^2 - 1 = 2(2(2\cos^2 t - 1)^2 - 1)^2 - 1$, which involves only even powers of cos t, so the coefficient of $(\cos t)^3$ is 0.

D 6. If $\log_a b = 64$, then $a^{64} = b$, $(a^2)^{32} = b$, and $(a^2)^{96} = b^3$. Thus $\log_{a^2} b^3 = 96$.

B 7. A number is divisible by 8 only if its last three digits are, so q must be 3 or 7. It is easy to determine that q cannot equal 7, so p = 3 and q = 3. The resulting number is divisible by 3, but not by 7, 9, or 16.

E 8. Team A wins the series if it wins the first two games or if it wins exactly one of the first two games and then the third game. This probability is (0.7)(0.7) + (0.7)(0.3)(0.7) + (0.3)(0.7)(0.7) = 0.784.

C 9. The number of elements in A - B could be the sum of any two numbers inside one circle and outside another. These are 4 + 4, 4 + 1, 1 + 3, 3 + 2, 2 + 0, and 0 + 4, which yield four distinct sums.

C 10. Graphically, a function has a fixed point if it intersects the line y = x. Since an odd degree polynomial approaches $+\infty$ in one direction and $-\infty$ in the other, it must cross this line. An even degree polynomial could lie entirely above the line; a sine curve must cross it; a rational function could have the line y = x as an asymptote. Thus the answer is two.

B 11. The function $e^{\ln x}$ is undefined for $x \le 0$; sin(arcsin x) is undefined for $|x| > 1$; arctan(tan x) = x only if x is between $-\pi/2$ and $\pi/2$; $\sqrt{x^2} = |x|$, not x; so the answer must be $\ln e^x$.

D 12. Let r be the radius of the table; then $(r - 2)^2 + (r - 9)^2 = r^2$, since the given point is one vertex of a right triangle. Then $r^2 - 22r + 85 = (r - 5)(r - 17) = 0$, and r > 9 implies r = 17.

A 13. The given triangle must have AC = 4x, BC = 3x, and AB = 5x. Then DC = 2x, $BD = x\sqrt{13}$, and $\cos \angle CDB = 2/\sqrt{13}$.

C 14. Let L = the distance Enrique walks on the level and H = the distance he walks uphill. Then L/4 + H/3 + H/6 = 6 hr. But then L + 2H = 24, and L + 2H is his total distance.

B 15. If $x^2 = x + 3$, then $x(x^2) = x(x + 3) = x^2 + 3x = (x + 3) + 3x = 4x + 3$.

D 16. There are 5 possible red sides. Of those sides, 4 have a red side on the other side, so the required probability is 4/5.

A 17. From the rules, if n is not a multiple of 5, then neither is 3n or n + 5. Since S starts out containing 2 (not a multiple of 5), S contains no multiples of 5, hence not 2000. For the other numbers, 2001 = 3(2 + 5(133)), 2002 = 2 + 5(400), 2003 = 3(3(2 + 5(44))) + 5, and 2004 = 3(3(3(2))) + 5(390).

C 18. We know ap + b = 18 and aq + b = 39, so a(q - p) = 21. Thus a = 1, 3, 7, or 21. But $a \ne 1$ (since then b = 0), $a \ne 21$ (since then b < 0), and $a \ne 3$ (since then b = 0). Thus a = 7, b = 4, p = 2, q = 5.

C 19. By definition of bisect, $\angle OBM = \angle OBC$ and $\angle OCL = \angle OCB$. But $\angle OBC = \angle BOM$ and $\angle OCB = \angle COL$ (by alternate interior angles). Thus $\angle OBM = \angle BOM$ and $\angle OCL = \angle COL$, so triangles OBM and OCL are isosceles with MB = MO and LC = LO. The perimeter of $\triangle SML$ = SB + SC = 30.

E 20. From the given information, $4B^2 = A^2 + B^2 + (B - 4)^2 + (B - 12)^2$, so $B^2 + 32B - 160 = A^2$. Completing the square yields $(B + 16)^2 - A^2 = 416$. The only positive integers satisfying this equation are A = 103, B = 89 (making Ed 178); A = 50, B = 38; A = 22, B = 14 (making Di 2 yrs old). Thus the only physically possible solution is: Al is 50, Bo is 38, Cy is 34, Di is 26, with total ages 148.