1) **C.** $x^2 - 9x - 10 = 0 \implies (x-10)(x+1) = 0$ so $a = 10$ and $b = -1$. Therefore, the answer is $(10)(-1) - (-1) - (10) + 1 = -18$.

2)**E.** Squaring both sides gives $x^2 = x + 2$, which implies $x^2 - x - 2 = 0 \rightarrow (x-2)(x+1) = 0$. Thus $x = 2$ or $x = -1$. However $x = -1$ does not satisfy the original equation. Therefore $x = 2$ is the only solution.

3) **B.** I: False if $x > 0$ and $y < 0$
II: True, since $(x-1)^2 \geq 0 \implies x^2 - 2x + 1 \geq 0$.
III: False, since if $x > y$ then $\dfrac{1}{x} < \dfrac{1}{y}$

4) **D.** The final solution is 55% water and has a total volume of 7.5 gallons. Thus $.55 = \frac{(.2)(2.5)+x}{7.5} \implies x = 3.625$. Thus the original solutions it $100\left(\frac{3.625}{5}\right) = 72.5$ percent water. So 27.5% is not water.

5) **A** To average 85mph he must complete the entire trip in 4 hours since $85 \cdot 4 = 340$. So he must get from B to C in 2 hours, and thus must travel at 90mph.

6) **A.** $m = \frac{7-5}{10+2} = \frac{1}{6}$ so $y - 7 = \frac{1}{6}(x - 10) \rightarrow 6y - 42 = x - 10$.

7) **D.** S is the number of student tickets sold and P is the number of adult tickets sold. $S + P = 100$ and $5S + 10P = 755$. Solving this we have that $S = 45$ and $P = 55$.

8) **C.** $(\sqrt{5} + \sqrt{7} - 1)(\sqrt{5} + \sqrt{7} + 1) = (\sqrt{5} + \sqrt{7})^2 - 1 = 2\sqrt{35} + 11$.
$(2\sqrt{35} + 11)(2\sqrt{35} - 11) = (2\sqrt{35})^2 - 11^2 = 4 \cdot 35 - 121 = 19$.

9) **C.** $f(6 + \alpha) = 2(6 + \alpha) + 1024 = 2\alpha + 1036$. Setting this equal to 18 we find that $\alpha = -509$.

10) **C.** Case 1: Solve $x - 1 + x + 2 = 4$, which gives $x = 1.5$.
Case 2: $x - 1 > 0$ and $x + 2 < 0$. This is not possible
Case 3: $x - 1 < 0$ and $x + 2 > 0$. Then $-2 < x < 1$, and solving $-(x-1) + x + 2 = 4$ gives $3 = 4$, which is false.
Case 4: $x - 1 < 0$ and $x + 2 < 0$. Then $x < -2$, and solving $-(x-1) - (x+2) = 4$ gives $x = -2.5$

So the solutions are $x = 1.5$ $x = -2.5$

11) **C.** $(x+y+1)^2 = x^2+y^2+2x+2y+2xy+1 = 9+2(x+y)+40+1 = 2(x+y)+50$.
Now using the fact that $9+2(20) = x^2+2xy+y^2 = (x+y)^2$ we have that $(x+y)^2 = 49$ so $x+y = \pm 7$. Thus $(x+y+1)^2 = 2(7)+50 = 64$ or $(x+y+1)^2 = 2(-7)+50 = 36$.

12) **D.** $x = ky$ and $y = \frac{w}{z}$, therefore $x = \frac{wk}{z}$. We are told that $10 = \frac{wk}{5} \implies wk = 50$ and $2 = \frac{w}{10} \implies w = 20$. So if $z = 10, x = 5$ and $y = 2$.

13) **B.** The distance from (0,0) to (3,4) is 5 by the distance formula. The distance from (3,4) to (8,16) is 13. Finally the distance from (8,16) to (0,0) is $8\sqrt{5}$. So a total of $18+8\sqrt{5}$ units was traveled. Thus it took $\frac{3}{10}+\frac{2}{15}\sqrt{5}$ minutes.

14) **E.** Subtracting twice the first equation from the second equation gives $y-x = -16$, so $x-y = 16$. You could also find that $x = \frac{13}{2}$ and $y = \frac{-19}{2}$.

15) **A.** I: true. II: false. For example $x = -18$ and $y = 1$. III: false. $693 = 9 \cdot 7 \cdot 11$ so the equation factors to $(x-7)(x+99)$.

16) **B.** A is Ann's age, and S is her sister's age. $A = 2S$ and $(A+5)+19 = 3(S+5) \implies A = 3S-9$. Solving $2S = 3S-9$ we have that $S = 9$ and $A = 18$. Thus in 3 years Ann will be 21.

17)**D.** Note that $4*3*2 = 24$. So $(16x^4+24x^2+9)-x^2 = (4x^2+3)^2-x^2 = (4x^2+x+3)(4x^2-x+3)$

18)**B.** $f(x)$ only intersects the y-axis at $x = 0$ so $A = 1$ and thus the answer is .2.

19) **C.** $f(x+\beta) = (x+\beta)^2+2(x+\beta)-1 = x^2+(2\beta+2)x+(\beta^2+2\beta-1)$. So we must have $2\beta+2 = 12$ which gives $\beta = 5$. Then this also satisfies $\beta^2+2\beta-1 = 34$.

20) **D.** Because if p had remainder 1, then $p+2$ wouldn't be prime (divisible by 3). If p had remainder 2, then it would be divisible by 2, which means it

couldn't be prime. If p had remainder 3, then it would be divisible by 3. If p had remainder 4, then $p+2$ would have 0 remainder (which means it's not prime). Therefore, p must have a remainder of 5.

21) **B.** The distance between Roland and Clara is shrinking at a rate of 5mph. Thus Roland will catch up to Clara in 10 hours.

22) **A.** The original distance of 100 is shrinking at a rate of 20 feet per second, so the dogs will collide in 5 seconds. So the flea travels at 100 feet per second for 5 seconds, thus it travels a total of 500 feet.

23) **C.** $F(x,y)+G(x,y) = x^2-2x+1+y^2+2y+1 = (x-1)^2+(y+1)^2 = 25$. Since $25 = 3^2+4^2$, we know the points $(3,4)$ and $(4,3)$ are translated by $(1,-1)$, giving $(4,3)$ and $(5,2)$. Also, the point $(0,5)$ which isn't originally in the first quadrant is placed in the first quadrant at $(1,4)$ when translated by $(1,-1)$.

24) **A.** $a_0 = 0$, $a_1 = 2$ $a_2 = 6$ $a_3 = 38$ $a_4 = 1446$.

25) **E** The shortest distance is equal to the distance from the origin to P, where P is the point we get by reflecting (-1,-1) over the line $x+y=1$. First we find the equation of the line through (-1,-1) that is perpendicular to x+y=1. This line is x=y. We then find the intersection point of these two lines, which is $\left(\frac{1}{2},\frac{1}{2}\right)$. This is the midpoint of P and (-1,-1). So P is the point (2,2). So the shortest distance is $2\sqrt{2}$.

26) **B.** $x = a_1$ and $y = a_2$. $A = 10x+y$ and $B = 10y+x$. $A+B = 11(x+y) = 121 \implies x+y = 11$. $A-B = 9(x-y) = 27 \implies x-y = 3$. Solving these gives us x=7 and y=4.

27) **D.** This is a right triangle with vertices (0,0) (0,4) and (2,0). So the area is just $\frac{2\cdot 4}{2} = 4$

28) **A.** $x^2+5x-7 = 4x-1 \implies x^2+x-6 = 0$. Which factors as $(x+3)(x-2) = 0$. Thus the two intersection points are (2,7) and (-3,-13).

29) **A.** $a = s - t$ so $-a = t - s$ which means that $c = 2 - a$

30) **E.** The discriminant of the equation is -4 thus there are no real roots.