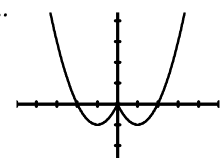
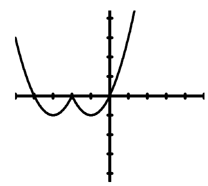
<u>Solutions</u>:

1. **C**. a=1 and a=2.
2. **B**. $2^8 5^8 (2^4) = 16 \times 10^8$ which has 10digits.
3. **A**. Solve $\frac{x+1}{x-2} = 3$ to get x=7/2. And on the number line put x=2 (domain issues). Check intervals and see that (2,3.5) is the interval solution. The only integer in that interval is 3, so the answer is "one" value of x.
4. **D**. The sum of the roots taken two at a time c/a, which is 8/2=4.
5. **C**. Factor $2^{98}(2^2 - 1) = 2^{98}(3)$ which has prime factors 2 and 3.
6. **A**. Change 2 to $\log_9 81$ and use properties of logs to get $\log_9(6x+40) = \log_9(\frac{81x}{3})$ so 6x+40=27x solves to 40/21, and times 42 gives 80.
7. **B**. $x = \pm 4\sqrt{2}$ and $y = \pm 3\sqrt{2}$ so the greatest difference is $7\sqrt{2}$ times $\sqrt{2}$ gives 14.
8. **B**. A googol is 10 to the 100th power.
9. **C**. $(4x^2 - 3) - (-\frac{1}{2}x + 2) = -\frac{1}{2}x$
   $4x^2 + x - 5 = 0$ solves to x=1 or -5/4. The integer answer is 1.
10. **C**. Multiply and take the square root.
11. **C**. His total cost is x(10-x) which is a parabolic curve with maximum at its vertex which occurs at x=5 since roots are 0 and 10. At x=5 the cost is 25.
12. **D**. Factor out 2 to get $x^2 + 4\sqrt{2}x + 8 = 0$ which factors to $(x+\sqrt{8})(x+\sqrt{8})$ so A=2, B=8 and BB/A is 64/2 = 32.
13. **A**. The sum of an infinite geometric series is $\frac{a_1}{1-r}$ = $\frac{1}{1-\frac{3}{4}}$ = 4.
14. **B**. For the parentheses, a=1, b=2 and we get 7. For 3@7 we get 98-3=95.

15. *C*. $x^2 - x - 12 < 0; (x-4)(x+3) < 0$ and this is a parabolic curve with the interval (-3, 4) below the x-axis. Integer values in that interval are -2, -1, 0, 1,2,3, and this is 6 values.
16. **A**. Cross multiply to get $2^{p-3+1} = 2^{3(p+1)}$ which solves to p= -5/2. $\frac{1}{2^{2(-5/2)}} = \frac{1}{2^{-5}} = 32$
17. **C**. Divide by 0.25 to get 21 quarters but but then we see that we do not have one of each coin. So we use 20 quarters, and that leaves 35 cents. We can have 3 dimes and a nickel for 35 cents with 4 extra coins. 24 coins total.
18. **C**. f is an even function so we have a parabolic curve with roots 0 and 2, and then we reflect it over the y-axis. For g we shift this curve to the left 2 units.

    f …
    
    g…
    

    Now, we can find the value of f at x=1 to get the min point and we see that it is (1,-1) and so the graph of g hits y= -1 twice. Once at x=-1 and once at x= -3. So 4(-3)-1=-13.
19. **C**. Use a, a+4 and a+8. So 2x+(a+8)=12+2(a+4) to get a=12 is the first. 5/4 times 16 (the second) is 20.
20. **B**. Solve the system to get x=3 and y= -4. 3/3-8/(-4)=1+2=3.
21. **D**. $\frac{x-y}{x} = \frac{1}{5}$ since 1/5 is 20%. Distribute to get $1 - \frac{y}{x} = \frac{1}{5}$ and so y/x is 4/5.
22. **C**. $C(6,n)\left(\frac{3}{x^3}\right)^{6-n}\left(-\frac{x^2}{3}\right)^n$ must have power -3 on x. So $2n - 3(6-n) = -3$ solves to 5n-18=-3 and n=3. So our coefficient is C(6,3)=20 times 3 to the power of 3, divided by (-3) to the power

of 3, for a total of -20.

23. B. $\left(\frac{1}{4}\right)^x = 30; 4^{-x} = 30$ and since the power of 4 must be between 2 and 3, -x=2 and –x=3 gives our bounds.

24. C. Let the vertex be (0, 100) and B be (40,0) to get $y - 100 = ax^2$ and use point B to get $a = -\frac{1}{16}$. Now let x=10 to get 375/4.

25. C. Since d-2<0, we negate the value of d-2 to get its abs. value. So 2-d – (c-4) gives 6-c-d.

26. D. Square to get $a + \left(\sqrt{2}+1\right) = \left(\sqrt{2}+1\right)^2$ and $a + \left(\sqrt{2}+1\right) = 3 + 2\sqrt{2}$ so
$a = 2 + \sqrt{2}$ so
$a^2 - 2a + 1 = (a-1)^2 = (1+\sqrt{2})^2$
$= 3 + 2\sqrt{2}$.

27. E. Use the discriminant to get $4k^2 + 4(15)$ must be a perfect square. Factor out 4 to get $k^2 + 15$ must be a perfect square. This first happens when k=1.

28. D. The jump-up-jump-back routine takes 6 seconds. So 10 of these happen in 60 seconds. Now, in each of these routines, the hand covers 60 degrees. so $10(\frac{60}{360} \bullet 20\pi)$ gives 100π/3.

29. C. Jack must have won 8 and Jill 17 for a total of 25.

30. B. $1^{\frac{1}{y}}$ gives only value **1**. $2^{\frac{2}{y}}$ gives **4**. $3^{\frac{3}{y}}$ gives **27**. $4^{\frac{4}{y}}$ gives values for y=1,2 and they are **256 and 16**. Then we get $5^5, 6^6, 6^{\frac{6}{2}}, 6^{\frac{6}{3}}, 7^7$ which give 5 new values.

Finally we get $8^{\frac{8}{y}}$ which gives values for y=1, 2, 3, 4, 6 although when y=4 we get 64 which was already listed. Same with y=6 since it is 16. And when y=6 we get 256, which was already listed. So our values are {1, 4, 27, 16, 64, 256, $5^5, 6^6, 6^{\frac{6}{2}}, 6^{\frac{6}{3}}, 7^7$, 8^8, 8^4} which gives 13 values.