Question #1

Use $f(x)=\sqrt{1+\sqrt{x}}$ for question #1, all parts.

$A = f(f(225))$.

$B = f^{-1}(4)$

C = the value of x for which $f(x-1)=2$.

D = the value of x for which $f\left(\frac{1}{x}\right)=2$.

Question #2

Use $a=\sqrt{-4}$ and $b=\sqrt{-9}$ for question #2, all parts.

$A = a \bullet b$ $B=\frac{a}{b}$ $C=a+b$ $D=(a+b)^2$

Question #3

Use $f(x)=(x-2)^{10}$ and $i=\sqrt{-1}$ for question #3.

$A=$ the coefficient of the 3rd term of the expansion of f.

B = the value of $f(i+1)$.

C = $f(\sqrt{2}+2)$.

$D=\dfrac{f(4)}{f(3+i)}$.

Question #4

Use the equation $x^2 - y^2 - 2x + 4y = 7$ for question #4.

$A =$ the length of the transverse axis of the graph.

$B =$ the positive slope of an asymptote of the graph.

$C =$ the value of the constant c of the equation of the asymptote $ax - by = c$, for $a > 0, b > 0$ and a and b have no common factors except 1.

$D =$ the distance from the center of the graph to a focus.

Question #5

In a jar there are 20 liters of a 10% saline (salt) solution.
The jar contains only salt and pure water. Use this information for #5, all parts.

$A =$ the amount of pure salt that must be added (in liters) to produce a 12% solution.

$B =$ the percent of salt that will be in the jar if 5 liters of a 20% solution are added.

$C =$ the percent of increase in solution (mixture) if 5 liters of solution are added.

$D =$ the amount of water that must be evaporated (leaving the same amount of salt) to produce a 25% saline solution.

Question #6

For each case, give the LEAST integer which is a solution of the inequality.

$A =$ the least integer x which is a solution of $4 - |x+5| > 0$.

$B =$ the least integer x which is a solution of $2x - x^2 + 15 > 0$.

$C =$ the least integer x which is a solution of $\sqrt{9 - x^2} > 1$.

$D =$ the least integer x which is a solution of $|x-1| < 4$.

Question #7

Use the set $S = \{1, 3, 5, 6, 8\}$ for question #7, all parts.

A = the probability that a number chosen at random from S is a positive integer factor of 40.
B = the probability that any two distinct numbers chosen at random from S has a sum greater than 11.
C = the probability that one number from S is randomly chosen and, given that the chosen number is odd, it is 3 or 5.
D = the probability that three numbers are randomly chosen from S and the sum of the three numbers is 9.

Question #8

Use $f(x) = x^2 - 4x + 4$, $g(x) = (x-1)^2 + 1$ and $h(x) = x^2 - 6x + 5$ for question #8.

$A =$ the number of functions (above) which have at least one real root.

$B =$ the number of negative values of g which exist over the domain $[-10, 10]$.

$C =$ the value of $f(g(3))$.

$D =$ the value of k so that the quadratic $y = x^2 - x + k$ has a root which is the same as the least root of h.

Question #9

$$A = \sqrt{5 + \sqrt{5 + \sqrt{5 + \sqrt{\ldots}}}}$$

$$B = \cfrac{2}{1 + \cfrac{2}{1 + \cfrac{2}{1 + \ldots}}}$$

$C =$ the value of x which makes $\sqrt{x - \sqrt{x - \sqrt{x - \sqrt{\ldots}}}}$ equal to 10.

$D =$ the 12th term of the sequence 1, 1, 2, 3, 5, 8, …

Question #10

Use L as the line with equation $3x-6y=6$ and P as line $y=3x-6$ for question #10.

A = the value of k so the line $5x+ky=9$ is perpendicular to line L.

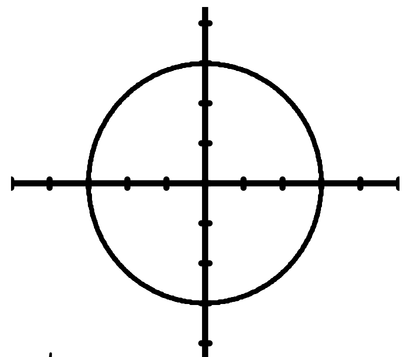
B = the value of u so that the line P intersects the parabola $y=ux-3x^2$ at the point $(1,-3)$.

$C=$ the sum of $a+b$ if lines L and P intersect at the point (a,b).

$D=$ the sum of the values of the intercepts of both lines. That is, if L and P have intercepts $(r,0),(0,s),(t,0)$ and $(0,w)$ then $D=r+s+t+w$.

Question #11

Refer to the circle with equation $x^2+y^2=9$ for question #11.



$A=$ the distance between the points on the circle with coordinates (1, a) and $(1,b)$.

$B=$ the area of the quadrilateral whose four vertices are the x- and y-intercepts of the circle,

$C=$ the probability that a point randomly chosen from the interior of the circle is also within the triangle with vertices $(-3,0),(3,0)$ and $(0,3)$.

$D=$ the number of steps a bug must take to complete one revolution around the circle. The bug begins on the point (3,0) and moves clockwise a distance of π units along the circle for each step that he takes. The first position at (3,0) is not counted as a step and the last step, at or before (3,0) is counted. The bug will not go past (3,0) to complete its final step.

Question #12

Use $a\#b=2ab-b$ for question #12.

$A=(1\#(2\#3))$

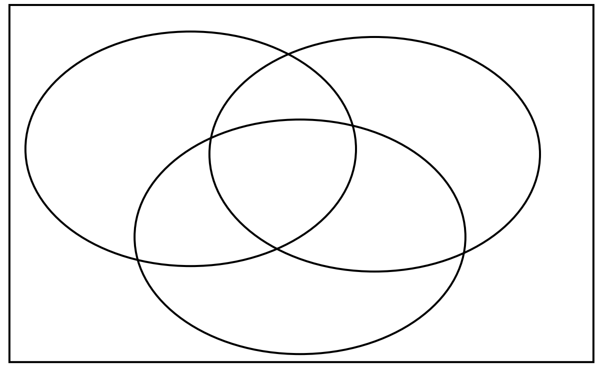
$B=\left(4\#\frac{1}{4}\right)-\left(3\#\frac{1}{3}\right)$

$C=$ the value of x such that $2\#x=4\#1$.

$D=$ the sum of the real values of x such that $\frac{1}{1\#x}$ is undefined.

Question #13

In a classroom, there are 22 students.
6 students have red shirts, 10 students have black pants, and 10 students are wearing white shoes. 3 students are wearing red shirts and white shoes; 6 students are wearing black pants and white shoes; 1 student is wearing a red shirt but not black pants nor white shoes;
1 student is wearing all three (red shirt, black pants, white shoes).



$A =$ the number of students who are wearing a red shirt and black pants.
$B =$ the number of students not wearing white shoes nor black pants.
$C =$ the number of students wearing a red shirt or black pants.
$D =$ the number of students not wearing a red shirt, nor black pants, nor white shoes.

Question #14

For this question, use the functions $f(x+1) = x^2 + 3x$ and $g(x) = \frac{x+2}{x-4}$.

$A =$ the constant term of the function $f(x)$.

$B =$ the greatest value of x such that $f(x) = 2$.

$C =$ the value of $f(k)$ given that k is the x-intercept of the graph of g.

$D = f\left(\frac{1}{g(-1)}\right)$