ANSWERS

1. A = 20	B = 3	C = -4	D = $6x$
2. A = -3	B = -6	C = 81	D = 14
3. A = 10	B = 36	C = 12.5 or $\frac{25}{2}$	D = 12.5 or $\frac{25}{2}$
4. A = 7	B = 6	C = 4	D = -3
5. A = 12	B = 16	C = 18	D = 5
6. A = equation	B = line	C = solution	D = algebra
7. A = 18	B = 174	C = 10	D = 0.05 or $\frac{1}{20}$
8. A = -47	B = 216	C = 39	D = 52
9. A = 3	B = 18	C = $\frac{15}{2}$ or 7.5	D = $-\frac{9}{5}$ or -1.8
10. A = 0	B=9	C =9	D = 6
11. A = 15	B = 1	C = 7	D = -12
12. A = -52	B = -2	C = 25	D = -56
13. A = -6	B = 1.5 or $\frac{3}{2}$	C = $-\frac{9}{4}$ or -2.25	D = 85
14. A = 73	B = 4	C = 4	D = -8
15. A=18	B=6.5 or $\frac{13}{2}$	C= 24	D= $y=-\frac{9}{14}x+\frac{81}{14}$

<u>Solutions:</u>

1. A = 20. B = 3 , C = –4 , D = $6x$

<u>Part A:</u> $\sqrt{8x^2y}\bullet\sqrt{32x^4y}$ = $\sqrt{2^8x^6y^2} = 2^4x^3y$, for positive x and y. $K\bullet x^M\bullet y^N$ is therefore equal to this, and K=16, M=3, N=1 and the sum is 20.

<u>Part B:</u> $\sqrt{300k}$ = $10\sqrt{3k}$ so the least integer to make the result integer is 3.

<u>Part C:</u> $1+\sqrt{x^2}=2$ has solutions 1 and -1 for G and H. $4\bullet G\bullet H$ = -4.

<u>Part D:</u> $\frac{\sqrt{8x}\bullet\sqrt{9x^2}}{\sqrt{2x}}$ = $\sqrt{4}\bullet\sqrt{9x^2} = 2(3x) = 6x$ for positive values of x.

----

2. A = -3, B =-6, C = 81, D = 14

<u>Part A:</u> $x^2-9=0$. $(x-3)(x+3)=0$ for solutions 3 and -3. So the least solution is -3.

<u>Part B:</u> $x^2-x=42$. $x^2-x-42=0$. $(x-7)(x+6)=0$. Solutions -6, 7 gives the least solution is -6.

<u>Part C:</u> $3x^2-27x=0$, $3x(x-9)=0$ has solutions 0 and 9. $0^2+9^2=81$.

<u>Part D:</u> $4\left(\frac{x^2}{4}-\frac{x}{2}=20\right)$, $x^2-2x-80=0$. $(x-10)(x+8)=0$. Since solutions $x_1<x_2$ give -8 < 10, the value of $2x_1+3x_2$ = 2(-8)+3(10) = -16+30= 14

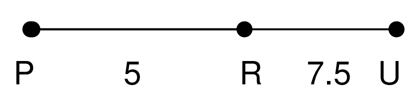
----

3. A = 10, B = 36, C = 12.5 or $\frac{25}{2}$, D = 12.5 or $\frac{25}{2}$

<u>Part A</u>: Distance is PQ=$\sqrt{(5-(-1))^2+(14-6)^2} = \sqrt{36+64} = 10$

<u>Part B</u>: $5=\frac{0+x}{2}$ and $14=\frac{y+2}{2}$. So x=10 and y=26. $x+y$ = 36.

<u>Part C</u>: Distance from P to R is 5, by the distance formula. So we are given that $5=\frac{2}{3}(RU)$. So RU = 7.5. R is between U and P. So PU = 5+7.5 = 12.5 or 25/2.



<u>Part D</u>: The midpoint of the segment with endpoints Q and R is $\left(\frac{5+3}{2},\frac{14+3}{2}\right)=(4,8.5)$ for a coordinate sum of 12.5 or 25/2.

----

4. A = 7 B = 6 C = 4 D = -3

Part A: $x^2+24^2=25^2$ gives $x^2=625-576=49$. So x is either 7 or -7. Since this is a length, the answer is 7.

Part B: $b^2+(b+2)^2=(b+4)^2$. $b^2+b^2+4b+4=b^2+8b+16$. $b^2-4b-12=0$. $(b-6)(b+2)=0$. The positive value for b is 6.

Part C: $c^2+(c-1)^2=(c+1)^2$. $c^2+c^2-2c+1=c^2+2c+1$. $c^2-4c=0$ Solves to c=0 or 4. Since a length cannot be 0, c=4.

Part D: See part C for the lengths of the legs are 3 and 4. Since 4 is the vertical distance, we have slope is $\frac{0-4}{3-0}=-\frac{4}{3}$. The equation of the line requested is $y=mx+n$ = $y=-\frac{4}{3}x+4$ and m= $-\frac{4}{3}$, n=4. So $n\div m$ = $4\left(\frac{-3}{4}\right)=-3$

---

5. A = 12 B = 16 C = 18 D = 5

Part A: $\frac{1}{20}t+\frac{1}{30}t=1$. Multiply by 60 to get 3t + 2t = 60. For t=12 minutes.

Part B: If Maurice works alone for 6 minutes, then he will have done $\frac{1}{30}(6)=\frac{1}{5}$ of the job. Now Natalie will do 4/5 of the job. $\frac{1}{20}t=\frac{4}{5}$. t=16 minutes.

Part C: If Maurice works alone for 10 minutes, then he will have done $\frac{1}{30}(10)=\frac{1}{3}$ of the job. Together they finish: $\frac{1}{30}t+\frac{1}{20}t=\frac{2}{3}$. Times 60 gives 2t+3t=40. t=8 minutes. We want the total time for Maurice, so the answer is 10+8 = 18.

Part D: If Maurice and Natalie work for ten minutes assembling the table, they will complete $\frac{1}{30}(10)+\frac{1}{20}(10)=\frac{1}{3}+\frac{1}{2}=\frac{5}{6}$ of the job. Then $\frac{1}{30}t=\frac{1}{6}$ gives that Maurice will complete the task in 5 more minutes. Answer is 5.

---

6. A = equation B = line C = solution D = algebra

Part A: 3 7 8 2 8 4 6 6 has the following choices DEF PQRS TUV for the first three letters. If the word starts with D then it must be DRU... If it starts with E then it can be EQU... ERU... ERD... and if it starts with F then it can be FRU... Since I cannot think of an algebra word starting with anything like any of these except EQU... EQUATION. Checking matches the rest of the code.

Part B: 5 4 6 3 starts JKL GHI MNO ... this fits the start of the word LINE.

Part C: 7 6 5 8 8 4 6 6 starts PQRS MNO JKL which fits POL...POK...ROL... SOL... and we can guess SOLUTION which matches.

Part D: 2 5 4 3 2 7 2 starts ABC JKL GHI. ALG... ALI... BLI... CHA... CHI... and guessing ALGEBRA does match.

7. A = 18 B = 174 C = 10 D = 0.05 or $\frac{1}{20}$

Part A: $|x+6|+3=12$. $|x+6|=9$. $x+6=9$ or $-x-6=9$. x= 3 or -15. For these solutions p and q, $|p-q|$ = 18.

Part B: $f(x)=\frac{1}{2}x^2-10x+1$, $f(-2)+f(-10)$ = $[2+20+1]+[50+100+1]=23+151=174$

Part C: $\frac{1}{2}x^2-10x+1=-49$, $\frac{1}{2}x^2-10x+50=0$. $x^2-20x+100=0$. $(x-10)(x-10)=0$. x=10.

Part D: $f(x)=\frac{1}{2}x^2-10x+1$, $f(-x)=f(x)+f(0)$ gives $\left(\frac{1}{2}x^2+10x+1\right)=\left(\frac{1}{2}x^2-10x+1\right)+1$ and $10x=-10x+1$. $x=\frac{1}{20}$ or 0.05.

---

8. A = –47 B = 216 C = 39 D = 52

Part A: $5-2a<101$. $-2a<96$. $a>-48$. The least integer value in the solution is -47.
Part B: $1000>7(b+3)-540$. $1540>7b+21$. $7b+21<1540$. $b+3<220$. $b<217$. The greatest integer in the solution set is 216.
Part C: $|c-10|<20$. $-20<c-10<20$. $-10<c<30$. Integers in the solution are -9, -8, -7, ... , 29. From -9 to -1 is a count of 9. From 1 to 29 is a count of 29. Zero adds one to the count. Total is 9+29+1=39.
Part D: $d\le 50$ and $d\ge -1$. This gives integers -1, 0, 1, ... 50 for a count of 52.

---

9. A = 3 B = 18 C = $\frac{15}{2}$ or 7.5 D = $-\frac{9}{5}$ or -1.8

Part A: $y=a(x+b)(x+c)$ would be $y=a(x-1)(x-5)$ but since the y-intercept is 3, $3=a(0+b)(0+c)$ so abc=3.

Part B: (-2.5,0) and (0, 3) gives slope $\frac{3}{2.5}=\frac{6}{5}$. The equation in standard form would start $6x-5y=k$ and using (0, 3) we have $6x-5y=-15$. $mx+ny=k$ matches and $\frac{m\bullet k}{n}$ = $\frac{6(-15)}{-5}=18$.

Part C: Using part B, let y=12. $6x-60=-15$. x=45/6 = $\frac{15}{2}$ or 7.5

Part D: From part A we have $y=a(x-1)(x-5)$ and since y=3 when x=0 gives $3=a(1)(5)$. a = $\frac{3}{5}$. The equation is then $y=\frac{3}{5}(x-1)(x-5)$. When x=2, y= 0.6(1)(-3) = -1.8

10. A = 0 B=9 C =9 D = 6

Part A: $2^{14}\bullet 5^{16}\bullet 3^2 = 10^{14}5^2 3^2$ which is 225 with fourteen zeros. In the units place is 0.
Part B: $2^{14}\bullet 5^{16}\bullet 3^2 = 10^{14}5^2 3^2$ which is 225 with fourteen zeros. Sum of digits is 9.
Part C: $\sqrt{2^{14}\bullet 5^{16}\bullet 3^2} = 10^7 5^1 3^1$ which is a 15 followed by seven zeros. 9 digits.
Part D: $\sqrt{2^{14}\bullet 5^{16}\bullet 3^2} = 10^7 5^1 3^1$ which is a 15 followed by seven zeros. 9 digits. Sum of the digits is 6.

11

A = 15 B = 1 C = 7 D = -12

Part A: $24x^2+34x-3 = (12x-1)(2x+3)$ is $(Ex+F)(Gx+J)$ for $E \geq G > 0$ E=12, F= -1, G=2 and J=3. E+J = 15.

.**Part B:** $28x^2-19x+3 = (7x-3)(4x-1)$ so E=7, F= -3, G=4 and J= -1. F+G = 1

Part C: $3x^2-27x=-42$. $3x^2-27x+42=0$. $x^2-9x+14=0$. $(x-7)(x-2)=0$. Greatest solution is 7.

Part D: $\frac{x-1}{x+2}-\frac{x+3}{x} = \frac{x(x-1)}{x(x+2)}-\frac{(x+2)(x+3)}{(x+2)x} = \frac{x^2-x-(x^2+5x+6)}{(x+2)x} = \frac{-6x-6}{(x+2)x} = \frac{Px+Q}{x^2+2x}$.

So $P+Q=$ -12.

---

12. A = -52 B = -2 C = 25 D = -56

Part A: $(2x-5)^3 = 8x^3-60x^2+150x-125$. The x^2 and x^3 terms have coefficient sum -60+8 = -52.

Part B: $(x-2)(3x^2-4)^2 = (x-2)(9x^4-24x^2+16) = 9x^5-18x^4-24x^3+48x^2+16x-32$
x^4 and x terms have a coefficient sum of -2.

Part C: $(2x-5)^3 = 8x^3-60x^2+150x-125$, from part A. The x and x^0 terms have a coefficient sum of 150-125 = 25.

Part D: $(x-2)(3x^2-4)^2 = 9x^5-18x^4-24x^3+48x^2+16x-32$ from part B. The x^3 and x^0 terms have a sum of -24-32 = -56.

13. A = -6 B = 1.5 or $\frac{3}{2}$ C = $-\frac{9}{4}$ or -2.25 D = 85

Part A: $\frac{x}{12}-\frac{1}{2}\left(\frac{x+1}{2}\right)=\frac{3}{4}$. Multiply by 12 to get $x-3(x+1)=9$. $-2x=12$. x= -6.

Part B: $f(x)=\frac{1}{x}$. $\frac{f(2)}{f(3)}$ = $\frac{1}{2}\div\frac{1}{3}$ = 1.5 or 3/2.

Part C: The line with intercepts $x=4$ and $y=-3$ are $\frac{x}{4}-\frac{y}{3}=1$. Multiply by 12. 3x-4y=12 and solve to get $y=\frac{3}{4}x-3$. This is $f(x)=mx+n$ so $m+n$ is -2.25 or $-\frac{9}{4}$

Part D: $f(x)=4x^2+5x+1$, $f(x+3)$ = $4(x+3)^2+5(x+3)+1$ = $4(x^2+6x+9)+5x+15+1$.
And to get the sum of the coefficients, let x=1 to get 64+21=85.

---

14. A = 73 B = 4 C = 4 D = -8

Part A: $f(x)=6x-1$ and $g(x)=\frac{4-x}{x-3}$. $f(12)-g(2)=$ $71-(-2)=73$

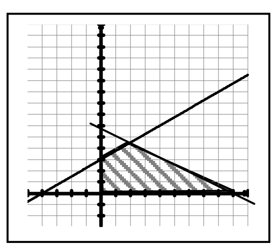
Part B: $f\left(\frac{1}{6}\right)=g(x)$ when $0=\frac{4-x}{x-3}$. This happens when the numerator is 0 at x=4.

Part C: $g(n)=\frac{4-n}{n-3}$. And we try n=3... undefined. n=4, g(n) = 0 which is an integer.
So the answer is 4.

Part D: We search for $f(x)=6x-1$ to be divisible by 7 for the interval $-10<x<10$.
At x= -9, y= -55; at x =-8, y=-49 and this is divisible by 7. Answer is -8.

---

15. A=18 B=6.5 or $\frac{13}{2}$ C= 24 D= $y=-\frac{9}{14}x+\frac{81}{14}$



Part A: Sketch the graphs to help. The inequalities would both be shaded down and in part A we look at quadrant I. It appears that at x=1 we have 3 points, at x=2 we have 4 points, at x=3 we have 3 points, at x=4 we have 3 points, at x=5 we have 2 points, at x=6 we have 2 points, at x=7 we have 1 point and at x=8 we have 0 points. Check: x=1: $y\le\frac{3}{4}x+3$, $y\le 3.75$ gives (1, 1), (1, 2), (1, 3). At x=2 we get $y\le 4.5$ for (2, 1), (2,2), (2, 3) and (2, 4)

At x=3 and using $y \le \frac{-9}{14}(x-9)$ from here on, we have 27/7 so (3, 1), (3,2) (3, 3). At x=4 we get 45/14 and (4,1), (4, 2) and (4, 3) work. At x=5 we have 18/7 so (5, 1) and (5, 2). At x=6 we have 27/14 for (6, 1) and (6, 2) and finally at x=7 we have 9/7 for (7, 1) only. A total of 18 points.

Part B: Get the point (2, 4.5) from the given equation of L_1. This is (p,q). $p+q$ =6.5.

Part C: Using the 18 points from part A, we only check our eye-count of 6 additional points on the y-axis and in QII. The total will be 24.

Part D: Using (2, 4.5) from part B and (9,0) from the given information, and ignoring the fact that I found this in part A, we get slope -4.5 / 7 or -9/ 14 so we use point-slope form of $y=-\frac{9}{14}(x-9)$ and then get $y=-\frac{9}{14}x+\frac{81}{14}$.

----

the end