1. D $3-9x \le 21; x \ge -2$

2. A $x^3+27=0; (x+3)(x^2-3x+9)=0$;

$x=-3$ or $x=\frac{3\pm 3i\sqrt{3}}{2}$

3. C $\log_2 x+\log_2(x+2)=3;\ \log_2(x^2+2x)=3$;

$x^2+2x-8=0; x=\cancel{-4},2$ and

$\log_3(y)(3y+8)=1; 3y^2+8y-3=0;$

$y=\frac{1}{3},\cancel{-3}$, sum of x and y is $2\frac{1}{3}$

4. B $(\log_2 4)(\log_3 5)\ldots(\log_{98}100)=$

$$\frac{\cancel{\log 4}}{\log 2}\bullet\frac{\cancel{\log 5}}{\log 3}\bullet\frac{\cancel{\log 6}}{\cancel{\log 4}}\bullet\frac{\cancel{\log 7}}{\cancel{\log 5}}\ldots\frac{\log 99}{\cancel{\log 97}}\bullet\frac{\log 100}{\cancel{\log 98}}=$$

$$\frac{\log 99\bullet\log 100}{\log 2\bullet\log 3}=\frac{2\log 99}{\log 2\bullet\log 3}$$

5. A $x^{\frac{4}{3}}+14x^{\frac{2}{3}}-51=0;$ letting $y=x^{\frac{2}{3}}$ gives

$y^2+14y-51=0; (y+17)(y-3)=0;$

$y=-17,3; x^{\frac{2}{3}}=-17$ no solution;

$x^{\frac{2}{3}}=3; x=3^{\frac{3}{2}}, x=3\sqrt{3}$

6.C $x^2+3x-9\ge 3x^2-14; 0\ge 2x^2-3x-5;$

$0\ge(2x-5)(x+1)$ makes the critical points

$\frac{5}{2},-1$. Plotting these on a number line and

testing the zones gives the solution $\left[-1,\frac{5}{2}\right]$

7. C $0=2x^2-7x+4; p^2+q^2=$ sum of squares of

roots = $\frac{b^2-2ac}{a^2}=\frac{49-2\bullet 2\bullet 4}{4}=\frac{33}{4}$;

$pq=$ product o the roots = $\frac{c}{a}=2$.

$\frac{33}{4}+\frac{8}{4}=\frac{41}{4}$

8. D $x+y=10, x^2+y^2=148$. Solving the first equation for x gives $x=10-y$. Substitute this in the 2nd equation to get $(10-y)^2+y^2=148;$

$100-20y+y^2+y^2=148;$

$2y^2-20y-48=0;$

$2(y-12)(y+2)=0; y=12,-2.$

$|-2-12|=14$

9. B $|17x-4|>3; 17x-4>3, x>\frac{7}{17};$

$17x-4<-3, x<\frac{7}{17}$. Plot the critical points on the number line and test the zones gives

$\left(-\infty,\frac{1}{17}\right)\cup\left(\frac{7}{17},\infty\right)$.

10. B $\sqrt{3+2\sqrt{3x}}=\sqrt{3x};$ squaring both sides gives $3+2\sqrt{3x}=3x;$ moving the 3 to the right hand side gives $2\sqrt{3x}=3x-3$. Square both sides $12x=9x^2-18x+9;$

$0=9x^2-30x+9; x=\frac{1}{3},3$. $\frac{1}{3}$ does not work, the solution is 3 which is only 1 solution.

11. A $y=\sqrt{110-\sqrt{110-\sqrt{110}}}$; substituting gives $y=\sqrt{110-y};$ square both sides

$y^2=110-y; y^2+y-110=0; y=\cancel{-11},10.$

12. C $3^{2x+1}=27^{x^2}; 3^{2x+1}=(3^3)x^2;$

$3^{2x+1}=3^{3x^2}; 2x+1=3x^2; x=-\frac{1}{3},1$

For the 2nd equation: $2^{-2}(2^{4x})=2^4(2^{-6y});$

$2^{4y-2}=2^{-6y+4}; 4y-2=-6y+4, y=\frac{3}{5}$,

the sum of $-\frac{1}{3}+1+\frac{3}{5}=\frac{19}{15}$

13. B $3x^2+4x+1<5; 3x^2+4x-4<0;$ factoring gives the critical points as $\frac{2}{3}, -2$. The integers between these two points are -1 and 0.

14. D $(-2x+y)^7$ we want the x^3y^4 term.

$\frac{7!}{4!3!}\bullet(-2x)^3(y)^4=35(-8x^3)y^4$

$=-280x^3y^4$

15. C $f(x)=-2x+1, g(x)=3x-1, h(x)=3$. Graph these lines and find the points of intersection. The points we want $(0,2),(1,2)$.

16. B $\frac{together}{Tom}+\frac{together}{Jerry}=1, \frac{x}{60}+\frac{x}{40}=1;$

$2x+3x=120, x=24\,\text{min}\,utes$

17. E $f\left(\frac{1}{2x}\right)=\frac{2x^2-1}{3x}$. To find the inverse of $\frac{1}{2x}$, which is $\frac{1}{2x}$ substituted that into get $f(x)$.

$$f(x)=\frac{2\left(\frac{1}{2x}\right)^2-1}{3\left(\frac{1}{2x}\right)}=\frac{1-2x^2}{3x},$$

$$f(2x)=\frac{1-2(2x)^2}{3\bullet 2x}=\frac{1-8x^2}{6x}.$$

18. A $\frac{1}{x-2}\geq\frac{2}{x+3}; x+3\geq 2x-4; x\leq 7$,test the discontinuities $x=2,-3$ to get $(-\infty,-3)\cup(2,7]$

19. C $-7<-2x+4\leq 3; \frac{11}{3}>x\geq\frac{1}{2}$

20. D Product of the roots is

$\frac{k\bullet(-1)^n}{a}=\frac{10(-1)^5}{2}=-5$

21. C $a^3+b^3=18, (a+b)(a^2-ab+b^2)=18;$

$(a+b)^2=3^2; a^2+2ab+b^2=9$

substituting $a+b=3$ gives

$3(a^2-ab+b^2)=18$, $\begin{array}{l} a^2-ab+b^2=6 \\ -(a^2+2ab+b^2)=9 \end{array}$,

adding these two equations gives $-3ab=-3, ab=1$.

Since $a^2-ab+b^2=6$ and knowing $ab=1$ we add $-ab=-1$ to the equation and get $a^2-2ab+b^2=5$ making $(a-b)^2=5, |a-b|=\sqrt{5}$.

22. B Find $f(x)$, plug in inverse of $2x+1$ which is $\frac{x-1}{2}$. $f(x)=\frac{9x+5}{2x+4}, f(-2x)=\frac{-18x+5}{-4x+4}$

23. A $x+4\leq 0, x\leq -4.$ Check domain restrictions $x^2+x-6=(x+3)(x-2)$ which gives $(-\infty,-4]\cup(-3,2)$.

24. D Subbing -1 in for x we get $1-b-3=0, b=-2$. Now we can find the quadratic is $x^2-2x-3=0$ which factors as $(x-3)(x+1)=0, x=-1,3$.

25. A For the 2nd equation, the value of the determinant of the left hand side has a value of $3x+2$, the right hand side has a value of $y-8$. Set these equal to each other and get $3x-y=-10$. Now solve the system $\begin{cases} 2x+y=-10 \\ 3x-y=-10 \end{cases}$ which gives a solution of $x=-4, y=-2$. The sum of these is -6.

26. D The center of the circle is (2,3) and the radius is 5. For the parabola, the vertex is $(2,-2)$ and the $y-$intercept is (0,10). Graph these two and find the number of points of intersection is 3.

27. A Opposite reciprocal slope. $7x+4y=B,$ plug in for B gives $7(-1)+4(-3)=B, B=-19$, $7x+4y=-19$. The $x-$intercept would be $\frac{C}{A}=-\frac{19}{7}$.

28. C Use Ps and Qs to find possible roots are $\frac{\pm(1,2,5,10)}{\pm(1,3)}$, 6 is not a possible root.

29. E The sum of the roots is $\frac{-b}{a}=-7$, product is $\frac{c}{a}=11$ so the factors of the new quadratic are $(x+7)(x-11)$ making the quadratic $x^2-4x-77=0$.

30. D

$$100x=32.3232...$$
$$x=.323232...$$

subtracting these gives $99x=32, x=\frac{32}{99}$