#1 $4i$

$$(3i)^2(-2i)+(4i^3)(-2i^2)+\left(\frac{3}{i}\right)\left(\frac{-2}{i^2}\right)=$$

$$-9(-2i)+(-4i)(2)+\left(\frac{-6}{-i}\right)=18i-8i-6i=4i$$

#2 31

$$\frac{8!}{5!3!}-\frac{6!}{2!4!}-\frac{5!}{3!2!}=56-15-10=31$$

#3 $-\frac{5}{2}$

$3^{5x}\bullet 9^{x^2}=27$; $3^{5x}\bullet 3^{2x^2}=3^3$. Since the bases are the same, $5x+2x^2=3$.
Solving the quadratic gives $x=\frac{1}{2},-3$. Sum is $-\frac{5}{2}$.

#4 $\frac{5}{16}$

$$\frac{2^{n+3}+2(2^n)}{2(2^{n+4})}=\frac{2^{n+3}+2^{n+1}}{2^{n+5}}=\frac{2^n(2^3+2^1)}{2^n(2^5)}=\frac{10}{32}=\frac{5}{16}$$

#5 $\frac{1}{2}$

$\frac{x+y}{x-y}=1,\ x+y=x-y$ solving this gives $2y=0, y=0.$

$\log 2B=0; 2B=1, B=\frac{1}{2}.$

#6 $\left(-\frac{5}{4},\frac{33}{36}\right)$

$y=-3\left(x^2-\frac{7}{3}+\frac{49}{36}\right)-5+\frac{147}{36};= y=-3\left(x-\frac{7}{6}\right)^2-\frac{33}{36}$. Vertex is $\left(\frac{7}{6},-\frac{33}{36}\right)$.

$-3=\frac{1}{4p}; p=-\frac{1}{12}$. Focus is $\left(\frac{7}{6},-1\right)$.

#7 $(-\infty,-2\,]\cup[0,1]$

$x^3+x^2-2x\le 0$; Factoring gives $x(x+2)(x-1)\le 0$, critical points would be $0,1,-2$. Put these on a number line and test zones.

#8 $2-a$

$$\log 50=\log 5+\log 10;\log\frac{10}{2}+\log 10=\log 10-\log 2+\log 10;1-\log 2+1=2-a$$

#9 2

$$S_n=\frac{a_1(1-r^n)}{1-r}. \qquad \frac{a_1\left(1-r^6\right)}{\cancel{1-r}}=9\frac{a_1(1-r^3)}{\cancel{1-r}};1-r^6=9-9r^3;$$

$0=r^6-9r^3+8;\left(r^3-8\right)\left(r^3-1\right)=0;r=2,1$. However 1 makes the denominator undefined so $r=2$.

#10 9

Eliminating denominators and combining like terms gives: $\begin{cases}3x+2y=23\\5x-y=21\end{cases}$.

Solve the system which gives $x=5, y=4$. Sum is 9.

#11 $\frac{35}{4}$

Solving the first equation gives $x=2$. Solving the second gives $y=-\frac{1}{4}$.

$$4x-3y=4\bullet 2-3\left(-\frac{1}{4}\right)=8+\frac{3}{4}$$

#12 $\frac{11-7\sqrt{3}}{13}$

$$\frac{1-\sqrt{3}}{5+2\sqrt{3}}\bullet\frac{5-2\sqrt{3}}{5-2\sqrt{3}}=\frac{11-7\sqrt{3}}{13}$$

#13 5

Working from the outside in: $\log_2(\log_x 25)=1;\log_x 25=2;x^2=25;x=\pm 5$, reject -5.

#14 $\dfrac{3x}{x^2-49}$

Common denominator is x^2-49. So we have

$\dfrac{21+3(x-7)}{x^2-49}=\dfrac{\cancel{21}+3x\cancel{-21}}{x^2-49}=\dfrac{3x}{x^2-49}$.

#15 $(-2,\infty)$

$\frac{1}{2}(12-5m)-\frac{7}{2}m<18$, multiply through by 2 giving

$(12-5m)-7m<36,-12m<24,m>-2$

#16 162

$e^{\ln 18+\ln 9}=e^{\ln 162}=162$

#17 $\sqrt[4]{5}$

$\sqrt[3]{\sqrt[4]{5}\bullet\sqrt[4]{25}}=\sqrt[3]{\sqrt[4]{5\bullet 25}}=\sqrt[4]{\sqrt[3]{125}}=\sqrt[4]{5}$

#18 $(0,\pm 4)$

Solving the first equation for y^2 and substituting in the 2nd equation gives

$2x^2+16+4x^2=16;6x^2=0;x=0,$ and substituting gives $y=\pm 4$.

#19 -24

Expanding by minors of the first column: $3\begin{vmatrix}0 & -2\\ -4 & 1\end{vmatrix}=-24$

#20 $\dfrac{16}{3}$

$z=\dfrac{kx^2}{y};\dfrac{3}{4}=\dfrac{81k}{2};6=324k;k=\dfrac{1}{54}$. $z=\dfrac{\frac{1}{54}\bullet 144}{\frac{1}{2}}=2\bullet\dfrac{1}{54}\bullet 144=\dfrac{16}{3}$

#21 $x^2-4x+1=0$

Roots are $\left(2-\sqrt{3}\right)$ and $\left(2+\sqrt{3}\right)$. Sum = 4 = $-\dfrac{b}{a}$. Product = 1 = $\dfrac{c}{a}$.

$a=1,b=-4,c=1$

#22 $\{2\pm 3i,-4\}$

One root is $2-3i$ so another root is $2+3i$. Using sum and product of roots, the quadratic for those roots is $x^2-4x+13=0$. Dividing this into $x^3-3x+52$ gives $x+4$ as a factor making -4 another root.

#23 729 or -729

$3=243r^4, r=\pm\frac{1}{3}, \frac{243}{\frac{1}{3}}=729, \frac{243}{\frac{-1}{3}}=-729$

#24 $x=-2y^2+12y-17$ or $x=-2(y-3)^2+1$

focus $\left(\frac{7}{8},3\right)$ and directrix $x=\frac{9}{8}$ so the vertex is $(1,3)$ Find *p*, the distance from the focus to the vertex. $p=\frac{1}{8}$ so $a=-2$. After graphing, you can see the parabola opens to the left, so the equation would be $x=-2(y-3)^2+1$.

#25 5

$\sqrt{x-4}+x=6$, isolate the root giving $\sqrt{x-4}=6-x$, square both sides, set =0, $x^2-13x+40=0$. Solving gives 8 or 5, reject the 8.