Solutions:

1. **A**. $2g2^{3(x+2)} = 2^{4x}$ so exponents are equal: $3(x+2)+1=4x$ and x=7 and 10-x=3.

2. **A**. $\frac{3^{4x}+3^{4x}}{3^{-x}} = 6$ so $\left(2g3^{4x}\right)g3^{x} = 6$ and so the 3 exponent must be equal to 1. So x=1/5.

3. **B**. Move terms to the left and factor by grouping: $x^{\frac{2}{3}}(x^{\frac{1}{3}}+4)-1(x^{\frac{1}{3}}+4)=0$ $(x^{\frac{1}{3}}+4)(x^{\frac{2}{3}}-1)=0$ gives q, r, s are 1 and -1, and -64 and|qrs/8|=8.

4. **D**. Divide each side by x, and by 3 and get $\frac{2}{3} = x^{\frac{1}{3}}$ and then cube both sides to get x=8/27. So a+2b=8+54=62.

5. **E**. $\sqrt{3}+3+\sqrt{27} = 4\sqrt{3}+3$ so p+q=7.

6. **C**. Square the first equation to get $x+2\sqrt{xy}+y=36$ and using the second equation gives x+y=36-4=32.

7. **C**. Cube root both sides to get $\frac{x+1}{x-1}=\frac{1}{2}$ which solves to x= -3, so |x|+1=4.

8. **D**. The domain of f is [1, inf) and the domain of g is (-inf, 1] so a and b are both 1.

9. **B**. Square both sides to get $x-\sqrt[3]{2-(4)}=16$. The inner parentheses comes from substitution of the original equation which was equal to 4. So $x=16-\sqrt[3]{2}=2^4-2^{\frac{1}{3}}$ so 6(4)(1/3)=8.

10. **C**. Two values: x=1 and x=4.

11. **B**. The inverse of $y=x^{\frac{2}{5}}$ is $y=x^{\frac{5}{2}}$ for positive values of x. g(2)=$\sqrt{32}$.

12. **D**. $g(x)=\sqrt{x}$ and $\sqrt{x}>20$ gives $x>400$ but since g(x) must be an integer then x must be 21 squared, or 441.

13. **B**. The sum and difference of cubes formulas give $x^3+8=9$ and $y^3-27=10$ so $x^3=1,\ y^3=37$ and the product $(xy)^3=37$.

14. **D**. The expression simplifies to $\frac{1}{4}x^{-\frac{13}{2}}$
so $4\left(\frac{1}{4}\right)\left(-\frac{13}{2}\right)$ gives -13/2.

15. **B**. $a^{\left(\frac{-1}{3}+\frac{-1}{2}+2\right)}=a^{\frac{1}{6}}$ so a is a perfect sixth
power, the least of which is 2^6

16. **D**. $f(3)=(8)^{\frac{2}{3}}=4$ and
$f(2)=8^{\frac{1}{2}}=2\sqrt{2}$.

17. **C**. $(2)^{(-3(-3)}=512$

18. **B**. $(x+1)^{\frac{m}{17}}=36$ and $x+1=36^{\frac{17}{m}}$, and
the values of m which give an integer
answer are 2 or 17, since 36 is a perfect
square. x=$36^{\frac{17}{2}}-1=6^{17}-1$. And k=17.

19. **B**. $4^{\frac{1}{4}}=2^{\frac{2}{4}}=2^{\frac{1}{2}}$

20. **E**. (12^4-1)=$(12^2-1)(12^2+1)$ so 143
and 145 are both factors. The first
factor can be reduced to (12-1)(12+1) so
11 and 13 are factors. All are therefore
factors.

21. **B**. Square both sides to get
$13+2\sqrt{22}=a+b+2\sqrt{ab}$ so ab=22
and a+b=13. Integers 2 and 11 make
both equations true, so a-b=9.

22. **E**. Factor $x^3+7^3=(x+7)(x^2-7x+49)$
and divide by x+7.

23. **B**. $\sum_{x=1}^{n}x=\frac{1}{2}n(n+1)$ and
$\sum_{x=1}^{n}x^{3}=\left(\frac{1}{2}n(n+1)\right)^2$ so a-b=0.
If you do not know the formulas,
then see the pattern by using two
terms and then three terms. Each time
the difference is 0.

24. **C**. $\binom{12}{0}+\binom{12}{1}+...+\binom{12}{12}$= 2^{12} as each
row of Pascal's triangle gives $2^{that\ row}$ so
b=12.

25. **A**. The equation gives $\log_2(\log_2 x)=8$
and then $2^8=\log_2 x$ and lastly $2^{2^8}=x$
and the only prime factor is 2.

26. **B**. $2^{\frac{x}{y}} = 2^{1+\frac{3}{x}}$ so $\frac{x}{y} = 1 + \frac{3}{x}$ and

$\frac{x}{y} = \frac{x+3}{x}$ which solves to

$\frac{x^2}{x+3}$.

27. **D**. $3^{2x} - 3g3^x + 2 = 0$ factors to

$(3^x - 2)(3^x - 1) = 0$. Since x is not 0

we know $3^x = 2$ so $3^{-x} = \frac{1}{2}$

28. **A**. $a = x^{-1}, b = y^{-1}$ and solve the system

$a - b = 1 - 1/4, \quad 2a - 5b = -1/3,$ to

get a= -11/36 so x= -36/11. Take the

absolute value and (36+2)/11 is the

result.

29. **C**.

$\frac{1}{1-i} + 1 + (1-i) + (-2i) + -2i(1-i)$

which gives

$\frac{1+i}{2} + 1 + 1 - i - 2i + -2i - 2$

= $\frac{1+i}{2} - 5i = \frac{1}{2} - \frac{9}{2}i$.

30. **C**. From the set $\{-4, -3, -1, 2, 3, 5\}$ we

have possible exponents :

$\frac{-4}{-3}, \frac{-4}{-1}, \frac{-4}{2}, \frac{-4}{3}, \frac{-4}{5}$,