

1. Given the line $y + 2x = 1$, find a line which is perpendicular to it and which intersects it at the point where it crosses the x-axis.
2. Given $f(x) = x^2 + 1$ and $g(x) = \frac{x+1}{x-1}$, find the domain and range of $f(g(x)) - g(f(x))$.
3. If $f(x) = e^x$, find and simplify the difference quotient $\frac{f(x+h)-f(x)}{h}$.
4. Find the domain and range of $\ln x^2$ and $2 \ln x$. Are they the same?
5. The parabola $y = x^2$ was rotated about the origin and shifted to make the parabola $y = -x^2 - 4x - 3$. Describe the rotation and shift.

6. Is $f(x) = \frac{x+1}{x^2+1}$ a one-to-one function?

7. If $f(x)=x+2$ and $g^{-1}(x) = x^3$, find the inverse of $f(g(x))$.

8. Find all solutions of $x^3 - x^2 - 3x + 2 = 0$.

9. Use Pascal's Triangle to find the solutions of $x^6 + 3x^4 + 3x^2 + 1 = 0$.

10. Find the asymptotes of $f(x) = \frac{e^{2x}-1}{e^{2x}-1}$.

11. Solve $\log_7(x - 1) + \log_7(x + 1) - 2\log_7(x) - 1 = 0$.
12. Given a triangle with angles $A = \pi/4$ and $B = \pi/6$ and sides $a = 2$ and $b = 4$, what is the area of the triangle?
13. The angles of a triangle are in the proportion $1 : 2 : 3$. What is the supplementary angle of the largest angle?
14. A pizza has the property that its area is 4 times its circumference. If a 30 degree slice of pizza is cut out, what is the area of the remaining pizza?
15. If $\cot \theta = 0.1$ what are the possible values of $\sec \theta$?

16. Simplify $f(x) = \frac{\cos^2(x)+2\cos(x)+1}{\sin^2(x)}$ and then solve $f(x) = 3$.
17. One leg of a right triangle is $1/4$ as long as the hypotenuse. If one of the angles in the triangle is θ , what are the possible values of $\tan \theta$?
18. What is the period of $2\sin^2(\pi x + 1)$?
19. Describe all possible solutions of $\sec(x) = -2$.
20. Notice that $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$. Use this to compute $\tan \pi/12$.

21. Solve $\cos(x/2 + \pi) + \cos(x/2 - \pi) = 1$ on the interval $[-\pi/2, \pi)$

22. Solve the system $x + y = 1$ and $x^2 - y^2 = 1$.

23. Solve the system $x + y + z = 1$ and $x + y - z = 1$.

24. For what values of the parameter k does the system $x - y = 1$ and $kx + k^2y = 1$ have no solutions?

25. What is the partial fraction decomposition of $\frac{x^4}{x^4 + 2x^2 + 1}$?

26. If $a_{k+1} = 3a_k$, what is $\frac{a_{2k}}{a_k}$?

27. Write $\frac{1}{1+1} + \frac{2}{4+1} + \frac{3}{9+1} + \frac{4}{16+1} + \dots$ using sigma notation.

28. $a_5 = 2$ and $a_9 = 18$ are elements of an arithmetic sequence. Compute $\sum_{n=1}^{100} a_n$.

29. $a_4 = 8$ and $a_6 = 6$ are elements of a geometric sequence. Find a_0 .

30. Find the sum $\sum_{n=0}^{11} (2^n - n)$.

31. Prove by induction that $n! > n^2$ for $n > 3$.
32. Use the binomial theorem to simplify $\sum_{n=0}^{10} {}_{10}C_n (-1)^n$.
33. In the expansion of $(\frac{1}{x} + x)^4$, what is the coefficient of x^2 ?
34. How many different phone numbers can there possibly be in the 801 area code?
35. There are 20 students in a tennis tournament. If Joe always finishes second, in how many ways can gold, silver, and bronze medals be awarded?

36. During practice, a pitcher throws 15 fastballs, 11 curve balls, and 4 sliders. What is the probability that his first pitch was not a fastball?
37. Joe and Dave are playing a card game. If the first card drawn is a diamond, the Dave wins. If the first card is not a diamond, then they draw a second card. If the second card is a diamond, then Joe wins. If not, the game is a tie. Who will likely win this game more often?
38. What is more likely, that you flip a coin and get the same result three times in a row, or that you draw two cards from a deck and they are both the same suit?
39. A room contains 25 cats. Of these, 16 have black on them, 12 have white on them, and 10 have both black and white on them. If a cat is chosen at random, what is the probability that it has no black or white on it?

40. A circle centered at the origin passes through $(1, 2)$. Write the equation for this circle in standard form and sketch it.
41. What kind of object is described by $y^2 + 4y = x^2 - 6x$? Sketch it and describe its main features.
42. An ellipse has center $(1, 1)$, eccentricity $\sqrt{3}/2$, and also passes through the origin. How many ellipses satisfy these requirements? Find foci and sketch.