1. Solve for x: $3x + 7 = 22$.
2. Solve for y: $5y - 3 = 12$.
3. Solve the system of linear equations: $x + y = 10$ $x - y = 2$
4. Solve for z: 2z^2 - 5z + 3 = 0 (quadratic equation).
5. Simplify: (2x^3y^2)^2
6. Simplify: (3x^2y^3)/(6xy^2)
7. If f(x) = x^2 + 5x - 3, find f(2).
8. If g(x) = 3x^2 - x + 4, find g(-1).
9. Calculate the slope of the line passing through the points (4, 7) and (9, 22).
10. Find the equation of the line passing through the point (3, 4) and parallel to the line $y = 2x + 5$.
11. Calculate the distance between the points (3, 4) and (7, 10).
12. Determine the midpoint of the line segment joining the points (-2, 5) and (4, -3).
13. Find the area of a triangle with sides 10, 12, and 14.
14. Find the perimeter of a rectangle with length 8 and width 5.
15. Calculate the circumference of a circle with a radius of 7.
16. Calculate the volume of a cylinder with a radius of 5 and height of 10.
17. Calculate the surface area of a sphere with a radius of 4.
18. Convert 45 degrees to radians.
19. Convert $2\pi/3$ radians to degrees.
20. Given a right triangle with legs of length 6 and 8, find the hypotenuse.
21. In a 30-60-90 triangle, if the shortest side is 5, find the length of the other two sides.
22. In a 45-45-90 triangle, if one leg is 7, find the length of the other leg and the hypotenuse.
23. Find the sine, cosine, and tangent of 30 degrees.
24. Find the sine, cosine, and tangent of $\pi/4$ radians.
25. Find the angle θ in degrees if $\sin(\theta) = 0.5$.
26. Solve the following trigonometric equation for $0 \le x \le 2\pi$: $\sin(x) = 0.7$
27. Find the area of a sector with a central angle of 60 degrees and radius of 5.
28. Find the length of the arc intercepted by a central angle of 45 degrees in a circle with radius 8.
29. Calculate the sum of the interior angles of a hexagon.
30. If the sum of the measures of the interior angles of a polygon is 1080 degrees, how many sides does the polygon have?
31. Two planes depart from the same airport. Plane A is traveling 350 miles per hour at a heading of 45 degrees. Plane B is traveling 400 miles per hour at a heading of 315 degrees. After 2 hours, how far apart are the two planes?
32. A pilot flies 150 miles due east and then 200 miles due north. How far is the plane from the starting point?
33. A plane's altitude increases by 500 feet per minute. How long will it take for the plane to reach an altitude of 12,000 feet?

34. A plane is flying at an altitude of 25,000 feet and begins to descend at a constant rate of 400 feet per minute. How long will it take for the plane to land (reach an altitude of 0 feet)?
35. A pilot needs to fly directly west but encounters a crosswind blowing from the north at 25 mph. If the plane's airspeed is 150 mph, what heading should the pilot maintain to fly directly west?
36. Convert 200 knots to miles per hour (1 knot = 1.15078 mph).
37. Calculate the fuel consumption in gallons per hour if a plane burns 0.3 gallons per mile and flies at a speed of 180 miles per hour.
38. If a plane has 500 gallons of fuel and burns 60 gallons per hour, how long can it stay airborne?
39. A pilot is flying a distance of 800 miles with a headwind of 20 mph. If the plane's airspeed is 200 mph, how long will the flight take?
40. A plane is flying at an altitude of 20,000 feet and spots a landmark at a 30-degree angle of depression. How far away is the plane from the landmark?
41. A pilot must fly a distance of 400 miles at a heading of 30 degrees. Calculate the eastward and northward components of this flight.
42. A plane travels 180 miles due north and then changes course to 60 degrees east of north and travels another 240 miles. What is the total displacement of the plane?
43. Solve the following logarithmic equation: log(x) + log(x-1) = 1 (logarithm base 10).
44. If the concentration of pollutants in a fuel mixture is reduced by 30% each hour, how many hours will it take for the initial concentration to be reduced by 90%?
45. If a plane's fuel efficiency is 5 miles per gallon and it is flying at an altitude of 30,000 feet, how much fuel does it use to climb to that altitude, assuming a constant rate of climb? (Hint: use the Pythagorean theorem)
46. A plane travels 1,500 miles in 3 hours with a tailwind, and the return trip against the same wind takes 5 hours. What is the speed of the wind?
47. A rotating beacon light completes one rotation every 12 seconds. What is the angular speed of the beacon in radians per second?
48. A pilot flies a distance of 300 miles on a bearing of 045 degrees, then turns and flies another 400 miles on a bearing of 135 degrees. Calculate the final bearing of the pilot from the starting point.
49. If the pressure in a plane's cabin decreases at a rate of 0.5 psi per 1,000 feet increase in altitude, by how much will the pressure decrease when the plane climbs from 10,000 feet to 25,000 feet?
50. Given a wind triangle with sides representing airspeed (A), groundspeed (G), and wind speed (W), if A = 200 mph, W = 30 mph, and the angle between A and W is 60 degrees, calculate G.

Solutions :

1. Solve for x: 3x + 7 = 22. 3x = 22 - 7 3x = 15 x = 15/3 x = 5
2. Solve for y: 5y - 3 = 12. 5y = 12 + 3 5y = 15 y = 15/5 y = 3
3. Solve the system of linear equations: x + y = 10 x - y = 2 Add the two equations: 2x = 12 x = 6 Substitute x into the first equation: 6 + y = 10 y = 10 - 6 y = 4
4. Solve for z: 2z^2 - 5z + 3 = 0 (quadratic equation). Use the quadratic formula ($z = [-b \pm \sqrt{(b^2-4ac)}] / 2a$): a = 2, b = -5, c = 3 $z = [5 \pm \sqrt{((-5)^2 - 4(2)(3))}] / (2 * 2)$ $z = [5 \pm \sqrt{(25 - 24)}] / 4$ $z = [5 \pm \sqrt{1}] / 4$ $z_1 = (5 + 1) / 4 = 6 / 4 = 3 / 2$ $z_2 = (5 - 1) / 4 = 4 / 4 = 1$
5. Simplify: (2x^3y^2)^2 (2^2)(x^3*2)(y^2*2) 4x^6y^4
6. Simplify: (3x^2y^3)/(6xy^2) (3/6)(x^2/x)(y^3/y^2) (1/2)(x)(y) (1/2)xy
7. If f(x) = x^2 + 5x - 3, find f(2). f(2) = (2)^2 + 5(2) - 3 f(2) = 4 + 10 - 3 f(2) = 11
8. If g(x) = 3x^2 - x + 4, find g(-1). g(-1) = 3(-1)^2 - (-1) + 4 g(-1) = 3 + 1 + 4 g(-1) = 8
9. Calculate the slope of the line passing through the points (4, 7) and (9, 22). m = (y2 - y1) / (x2 - x1) m = (22 - 7) / (9 - 4) m = 15 / 5 m = 3
10. Find the equation of the line passing through the point (3, 4) and parallel to the line y = 2x + 5. Parallel lines have the same slope. The given line has a slope of 2. Using point-slope form, y - y1 = m(x - x1): y - 4 = 2(x - 3) y - 4 = 2x - 6 y = 2x - 6 + 4 y = 2x - 2
11. Calculate the distance between the points (3, 4) and (7, 10). Use the distance formula: $d = \sqrt{[(x2 - x1)^2 + (y2 - y1)^2]}$ $d = \sqrt{[(7 - 3)^2 + (10 - 4)^2]}$ $d = \sqrt{[4^2 + 6^2]}$ $d = \sqrt{(16 + 36)}$ $d = \sqrt{52}$ $d \approx 7.21$
12. Determine the midpoint of the line segment joining the points (-2, 5) and (4, -3). Use the midpoint formula: M(x, y) = ((x1 + x2)/2, (y1 + y2)/2) M = ((-2 + 4)/2, (5 - 3)/2) M = (1, 1)
13. Find the area of a triangle with sides 10, 12, and 14. Use Heron's formula: Area = $\sqrt{[s(s - a)(s - b)(s - c)]}$, where s = (a + b + c)/2 s = (10 + 12 + 14)/2 = 18 Area = $\sqrt{[18(18 - 10)(18 - 12)(18 - 14)]}$ Area = $\sqrt{[18(8)(6)(4)]}$ Area = $\sqrt{(13824)}$ Area ≈ 72.56
14. Find the perimeter of a rectangle with length 8 and width 5. Perimeter = 2(length + width) Perimeter = 2(8 + 5) Perimeter = 2(13) Perimeter = 26
15. Calculate the circumference of a circle with a radius of 7. Circumference = 2πr Circumference = 2π(7) Circumference ≈ 44
16. Calculate the volume of a cylinder with a radius of 5 and height of 10. Volume = $\pi r^2 h$ Volume = $\pi(5^2)(10)$ Volume = π(25)(10) Volume ≈ 785.4
17. Calculate the surface area of a sphere with a radius of 4. Surface Area = $4\pi r^2$ Surface Area = $4\pi(4^2)$ Surface Area = 4π(16) Surface Area ≈ 256π Surface Area ≈ 201.06
18. Convert 45 degrees to radians. Radians = (π/180) * Degrees Radians = (π/180) * 45 Radians = π/4

19. Convert $2\pi/3$ radians to degrees. Degrees = $(180/\pi) * \text{Radians}$ Degrees = $(180/\pi) * (2\pi/3)$ Degrees = 120
20. Given a right triangle with legs of length 6 and 8, find the hypotenuse. Use the Pythagorean theorem: $a^2 + b^2 = c^2$ $6^2 + 8^2 = c^2$ $36 + 64 = c^2$ $100 = c^2$ $c = \sqrt{100}$ $c = 10$
21. In a 30-60-90 triangle, if the shortest side is 5, find the length of the other two sides. In a 30-60-90 triangle, the sides are in the ratio $1:\sqrt{3}:2$. Shortest side (opposite 30°) = 5 Side opposite 60° = $5\sqrt{3}$ Hypotenuse (opposite 90°) = 5 * 2 = 10
22. In a 45-45-90 triangle, if one leg is 7, find the length of the other leg and the hypotenuse. In a 45-45-90 triangle, the legs are equal, and the hypotenuse is $\sqrt{2}$ times the length of a leg. Both legs = 7 Hypotenuse = $7\sqrt{2}$
23. Find the sine, cosine, and tangent of 30 degrees. $\sin(30°) = 1/2$ $\cos(30°) = \sqrt{3}/2$ $\tan(30°) = 1/\sqrt{3}$ or $\sqrt{3}/3$
24. Find the sine, cosine, and tangent of $\pi/4$ radians. $\sin(\pi/4) = \sqrt{2}/2$ $\cos(\pi/4) = \sqrt{2}/2$ $\tan(\pi/4) = 1$
25. Find the angle θ in degrees if $\sin(\theta) = 0.5$. $\theta = \arcsin(0.5)$ $\theta \approx 30°$
26. Solve the following trigonometric equation for $0 \leq x \leq 2\pi$: $\sin(x) = 0.7$ $x = \arcsin(0.7)$ $x \approx 0.775$ (in radians) or 44.4° (in degrees) Also, $x = \pi - 0.775 \approx 2.367$ (in radians) or 180° - 44.4° = 135.6° (in degrees)
27. Find the area of a sector with a central angle of 60 degrees and radius of 5. Area = $(1/2) * r^2 * \theta$ (in radians) Convert 60° to radians: $60 * (\pi/180) = \pi/3$ Area = $(1/2) * 5^2 * (\pi/3)$ Area ≈ 13.1
28. Find the length of the arc intercepted by a central angle of 45 degrees in a circle with radius 8. Arc length = $r * \theta$ (in radians) Convert 45° to radians: $45 * (\pi/180) = \pi/4$ Arc length = $8 * (\pi/4)$ Arc length ≈ 6.28
29. Calculate the sum of the interior angles of a hexagon. Sum of interior angles = (n - 2) * 180°, where n is the number of sides Sum = (6 - 2) * 180° Sum = 4 * 180° Sum = 720°
30. If the sum of the measures of the interior angles of a polygon is 1080 degrees, how many sides does the polygon have? Sum of interior angles = (n - 2) * 180° 1080° = (n - 2) * 180° n - 2 = 1080°/180°
31. Two planes depart from the same airport. Plane A is traveling 350 miles per hour at a heading of 45 degrees. Plane B is traveling 400 miles per hour at a heading of 315 degrees. After 2 hours, how far apart are the two planes? Distance of Plane A after 2 hours = 2 * 350 = 700 miles Distance of Plane B after 2 hours = 2 * 400 = 800 miles Use the Law of Cosines: $c^2 = a^2 + b^2 - 2ab * \cos(C)$ Angle between plane paths = |315° - 45°| = 270° $\text{Distance}^2 = 700^2 + 800^2 - 2(700)(800) * \cos(270°)$ $\text{Distance}^2 = 490000 + 640000 + 1120000$ $\text{Distance}^2 = 2260000$ Distance ≈ 1503 miles
32. A pilot flies 150 miles due east and then 200 miles due north. How far is the plane from the starting point? Use the Pythagorean theorem: $a^2 + b^2 = c^2$ $150^2 + 200^2 = c^2$ $22500 + 40000 = c^2$ $62500 = c^2$ $c = \sqrt{62500}$ c = 250 miles

33. A plane's altitude increases by 500 feet per minute. How long will it take for the plane to reach an altitude of 12,000 feet? Time = altitude change / rate of change Time = 12,000 feet / 500 feet per minute Time = 24 minutes
34. A plane is flying at an altitude of 25,000 feet and begins to descend at a constant rate of 400 feet per minute. How long will it take for the plane to land (reach an altitude of 0 feet)? Time = altitude change / rate of change Time = 25,000 feet / 400 feet per minute Time = 62.5 minutes
35. A pilot needs to fly directly west but encounters a crosswind blowing from the north at 25 mph. If the plane's airspeed is 150 mph, what heading should the pilot maintain to fly directly west? Use the Pythagorean theorem to find the groundspeed in the west direction: $a^2 + b^2 = c^2$ $a^2 + 25^2 = 150^2$ $a^2 = 150^2 - 25^2$ $a^2 = 20625$ $a \approx 143.6$ mph Use the inverse tangent function to find the angle: $\tan(\theta) = 25 / 143.6$ $\theta \approx 9.9°$ south of west
36. Convert 200 knots to miles per hour (1 knot = 1.15078 mph). 200 knots * 1.15078 mph/knot ≈ 230.16 mph
37. Calculate the fuel consumption in gallons per hour if a plane burns 0.3 gallons per mile and flies at a speed of 180 miles per hour. Fuel consumption = 0.3 gallons/mile * 180 miles/hour Fuel consumption = 54 gallons/hour
38. If a plane has 500 gallons of fuel and burns 60 gallons per hour, how long can it stay airborne? Time = fuel capacity / fuel consumption rate Time = 500 gallons / 60 gallons per hour Time ≈ 8.33 hours
39. A pilot is flying a distance of 800 miles with a headwind of 20 mph. If the plane's airspeed is 200 mph, how long will the flight take? Groundspeed = airspeed - headwind Groundspeed = 200 mph - 20 mph Groundspeed = 180 mph Time = distance / groundspeed Time = 800 miles / 180 mph Time ≈ 4.44 hours
40. A plane is flying at an altitude of 20,000 feet and spots a landmark at a 30-degree angle of depression. How far away is the plane from the landmark? Use the tangent function: $\tan(\theta)$ = opposite/adjacent $\tan(30°)$ = 20,000 feet / distance distance = 20,000 feet / $\tan(30°)$ distance ≈ 34,641 feet
41. A pilot must fly a distance of 400 miles at a heading of 30 degrees. Calculate the eastward and northward components of this flight. Eastward component = 400 * $\cos(30°)$ ≈ 346.41 miles Northward component = 400 * $\sin(30°)$ ≈ 200 miles
42. A plane travels 180 miles due north and then changes course to 60 degrees east of north and travels another 240 miles. What is the total displacement of the plane? Eastward component = 240 * $\cos(60°)$ = 120 miles Northward component = 180 + 240 * $\sin(60°)$ = 180 + 207.85 ≈ 387.85 miles Displacement = $\sqrt{(120^2 + 387.85^2)}$ ≈ 408.08 miles
43. Solve the following logarithmic equation: $\log(x) + \log(x-1) = 1$ (logarithm base 10). $\log((x)(x-1)) = 1$ $(x)(x-1) = 10^1$ $x^2 - x = 10$ $x^2 - x - 10 = 0$ $(x - 5)(x + 2) = 0$ $x = 5$ or $x = -2$ (discard $x = -2$, as it is not valid in the logarithm)

44. If the concentration of pollutants in a fuel mixture is reduced by 30% each hour, how many hours will it take for the initial concentration to be reduced by 90%? Final concentration = initial concentration * (1 - reduction rate)^time 0.1 = (1 - 0.3)^time 0.1 = 0.7^time log(0.1) = time * log(0.7) time ≈ 5.19 hours
45. If a plane's fuel efficiency is 5 miles per gallon and it is flying at an altitude of 30,000 feet, how much fuel does it use to climb to that altitude, assuming a constant rate of climb? (Hint: use the Pythagorean theorem) Horizontal distance = altitude / sin(angle of climb) Horizontal distance = 30,000 feet / sin(45°) ≈ 42,426 feet Horizontal distance in miles = 42,426 feet / 5,280 feet per mile ≈ 8.03 miles Fuel consumption = distance / fuel efficiency Fuel consumption = 8.03 miles / 5 miles per gallon ≈ 1.61 gallons
46. A plane travels 1,500 miles in 3 hours with a tailwind, and the return trip against the same wind takes 5 hours. What is the speed of the wind? Plane speed with tailwind = 1,500 miles / 3 hours = 500 mph Plane speed against tailwind = 1,500 miles / 5 hours = 300 mph Wind speed = (plane speed with tailwind - plane speed against tailwind) / 2 Wind speed = (500 - 300) / 2 = 100 mph
47. A rotating beacon light completes one rotation every 12 seconds. What is the angular speed of the beacon in radians per second? Angular speed = 2π radians per rotation / 12 seconds per rotation Angular speed ≈ 2π/12 ≈ 0.524 radians per second.

48.A pilot flies a distance of 300 miles on a bearing of 045 degrees, then turns and flies another 400 miles on a bearing of 135 degrees. Calculate the final bearing of the pilot from the starting point. Initial eastward component = 300 * cos(45°) ≈ 212.13 miles Initial northward component = 300 * sin(45°) ≈ 212.13 miles Second eastward component = 400 * cos(45°) ≈ 282.84 miles Second northward component = -400 * sin(45°) ≈ -282.84 miles Total eastward component = 212.13 + 282.84 ≈ 494.97 miles Total northward component = 212.13 - 282.84 ≈ -70.71 miles Final bearing = atan2(-70.71, 494.97) ≈ -8.11 degrees Convert to bearing: 360 + (-8.11) ≈ 351.89 degrees

49. If the pressure in a plane's cabin decreases at a rate of 0.5 psi per 1,000 feet increase in altitude, by how much will the pressure decrease when the plane climbs from 10,000 feet to 25,000 feet? Altitude difference = 25,000 - 10,000 = 15,000 feet Pressure decrease = 0.5 psi/1,000 feet * 15,000 feet = 7.5 psi
50. Given a wind triangle with sides representing airspeed (A), groundspeed (G), and wind speed (W), if A = 200 mph, W = 30 mph, and the angle between A and W is 60 degrees, calculate G. Use the law of cosines: $G^2 = A^2 + W^2 - 2 * A * W * \cos(60°)$ $G^2 = 200^2 + 30^2 - 2 * 200 * 30 * \cos(60°)$ $G^2 \approx 31{,}716$ G = √31,716 ≈ 178.1 mph