

1. Convert each of the following into radians.

- a) 180° c) 90° e) 120° g) -360° i) 150°
 b) -60° d) 135° f) 210° h) 15° j) 300°

2. In case of each of the following angles, state its sine, cosine, and tangent.

- a) 120° b) 330° c) -300° d) 225° e) -270°

3. Convert each of the following into degrees.

- a) $\frac{\pi}{2}$ c) $\frac{2\pi}{3}$ e) $\frac{3\pi}{2}$ g) 3π i) $\frac{7\pi}{12}$
 b) $-\pi$ d) $-\frac{\pi}{4}$ f) $\frac{3\pi}{4}$ h) $\frac{5\pi}{3}$ j) $\frac{5\pi}{6}$

4. Simplify each of the following. (Write it in terms of $\sin \alpha$, $\cos \alpha$, and $\tan \alpha$.)

- a) $\sin(\alpha + 360^\circ)$ c) $\tan(\alpha - 180^\circ)$ e) $\cos(-\alpha)$ g) $\sin(\alpha - 180^\circ)$
 b) $\cos(\alpha + 180^\circ)$ d) $\sin(180^\circ - \alpha)$ f) $\tan(-\alpha)$ h) $\tan(180^\circ - \alpha)$

5. Completely factor each of the following.

- a) $x^3 + x^2 - 2x$ b) $x^5 - 9x^3$ c) $6x^2 - 11x - 10$ d) $x^4 - 1$

6. Solve each of the following equations.

- a) $\sqrt{2x-1} = 2 + \sqrt{x-4}$ b) $\sqrt{x+1} + \sqrt{5x+1} = 6$

7. Find the domain of each of the following.

- a) $f(x) = \sqrt{25-x^2}$ b) $g(x) = \frac{x+2}{-5+\sqrt{x-2}}$ c) $h(x) = \sqrt{x-5} + \sqrt{8-x} - \frac{1}{x^2-36}$

8. Simplify each of the following.

- a) $-16^{-3/4}$ c) $(-16)^{-1/4}$ e) $\log_2 \sqrt{8}$ g) $\log_5 (5^{100})$ i) $\log_{\sqrt{3}} \left(\frac{1}{9}\right)$
 b) $(-8)^{-1/3}$ d) $(-5)^0$ f) $\log_4 \left(\frac{1}{\sqrt{8}}\right)$ h) $2^{\log_2 16}$ j) $\log_{0.1} 1000$

9. Let $f(x) = 2x - 3$ and $g(x) = x^2 + 1$. Compute each of the following.

- a) $f(g(-2))$ b) $g(f(-2))$ c) $f(f(2))$ d) $f(f(f(2)))$ e) $f(g(f(3)))$

10. One number a is five more than twice another number b . Find the smallest value of $a = 2b + 5$

- a) $a^2 + b^2$ b) ab c) $a^2 - b^2$

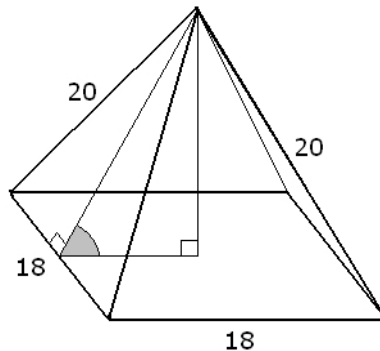
11. Compute the exact value of each of the following.

- a) $\sin 30^\circ \cos(-45^\circ) - \tan 120^\circ$ c) $2 \sin 120^\circ \cos 240^\circ$ e) $\sin 28^\circ - \cos 62^\circ$
 b) $\sec 135^\circ - \tan(-45^\circ) + \sin^2 120^\circ$ d) $\sin^2 18^\circ + \cos^2 18^\circ$

12. Prove the identity $\tan^2 x + 1 = \sec^2 x$.

13. Consider a circle with radius 10 m. Let P be a point 35 m away from the center of the circle. Compute the angle formed between the two tangent lines drawn from P to the circle.

14. Compute the area of a triangle with sides 15 m, 15 m, and 22 m.
15. Suppose that α is an acute angle. (An acute angle is one between 0 and 90°)
- Find the exact value of $\tan \alpha$ if $\cos \alpha = \frac{1}{3}$.
 - Find the exact value of $\cos \alpha$ if $\tan \alpha = 2$.
16. Solve each of the following equations.
- $\log_3(x - 2) = 1$
 - $\ln(3x - 1) = 2$
 - $\frac{\log_3(x + 1) - 1}{2} = 3$
 - $\frac{\log_3(x - 4)}{2} - 1 = 3$
 - $\frac{2}{3} \ln(x - 1) + 6 = 4$
 - $\frac{2}{3} (\ln(x - 1) + 6) = 4$
 - $3 - 5 \log_2(x + 1) = 8$
 - $11 - 8 \ln(3x + 1) = 7$
 - $7 - 2 \log_2(5x - 1) = 3$
17. Solve each of the following equations.
- $3^{2x-1} = \frac{1}{27}$
 - $2^{\frac{1}{3}x+1} = 32$
 - $3^{2x-1} = 10$
 - $e^{3x-1} = 10$
 - $2^{5x+1} = -1$
 - $3^{2x-10} = 3^{x-2}$
 - $3^{3x-1} = 9^{x-1}$
 - $e^{-\ln x} = 5$
18. Consider circles C_1 and C_2 with the following property. An arc subtended in C_1 by a central angle of 20° has the same length as an arc subtended in C_2 by a central angle of 15° . Find the ratio between the areas of the two circles.
19. Find the equation of the circle that passes through $A(1, -3)$, $B(3, 3)$, and $C(7, -5)$.
20. A water storage tank has the shape of a cylinder with diameter 10 feet. It is mounted so that the circular cross sections are vertical. If the depth of the water is 7 feet, what percentage of the total capacity is used?
21. A straight pyramid has a square base with sides 18 units long. All other edges are 20 units long. Compute the angle formed by the base and a triangular face.



Answers

1.) a) π b) $-\frac{\pi}{3}$ c) $\frac{\pi}{2}$ d) $\frac{3\pi}{4}$ e) $\frac{2\pi}{3}$ f) $\frac{7\pi}{6}$ g) -2π h) $\frac{\pi}{12}$ i) $\frac{5\pi}{6}$ j) $\frac{5\pi}{3}$

2.) a) $\sin 120^\circ = \frac{\sqrt{3}}{2}$ $\cos 120^\circ = -\frac{1}{2}$ $\tan 120^\circ = -\sqrt{3}$

b) $\sin 330^\circ = -\frac{1}{2}$ $\cos 330^\circ = \frac{\sqrt{3}}{2}$ $\tan 330^\circ = -\frac{\sqrt{3}}{3}$

c) $\sin(-300^\circ) = \frac{\sqrt{3}}{2}$ $\cos(-300^\circ) = \frac{1}{2}$ $\tan(-300^\circ) = \sqrt{3}$

d) $\sin(225^\circ) = -\frac{\sqrt{2}}{2}$ $\cos(225^\circ) = -\frac{\sqrt{2}}{2}$ $\tan(225^\circ) = 1$

d) $\sin(-270^\circ) = 1$ $\cos(-270^\circ) = 0$ $\tan(-270^\circ) = \text{undefined}$

3.) a) 90° b) -180° c) 120° d) -45° e) 270° f) 135° g) 540° h) 300°
i) 105° j) 150°

4.) a) $\sin \alpha$ b) $-\cos \alpha$ c) $\tan \alpha$ d) $\sin \alpha$ e) $\cos \alpha$ f) $-\tan \alpha$ g) $-\sin \alpha$ h) $-\tan \alpha$

5.) a) $x(x+2)(x-1)$ b) $x^3(x+3)(x-3)$ d) $(2x-5)(3x+2)$ d) $(x+1)(x-1)(x^2+1)$

6.) a) 13, 5 b) 3 (24 doesn't work) 7.) a) $[-5, 5]$ b) $[2, \infty) \setminus \{27\}$ c) $[5, 8] \setminus \{6\}$

8.) a) $-\frac{1}{8}$ b) $-\frac{1}{2}$ c) undefined d) 1 e) $\frac{3}{2}$ f) $-\frac{3}{4}$ g) 100 h) 16 i) -4 j) -3

9.) a) 7 b) 50 c) -1 d) -5 e) 17 10.) a) 5 b) $-\frac{25}{8}$ c) $-\frac{25}{3}$

11.) $\frac{\sqrt{2}}{4} + \sqrt{3}$ b) $\frac{7}{4} - \sqrt{2}$ c) $-\frac{\sqrt{3}}{2}$ d) 1 e) 0

12.) $\tan^2 x + 1 = \sec^2 x$

$$\text{LHS} = \tan^2 x + 1 = \left(\frac{\sin x}{\cos x}\right)^2 + 1 = \frac{\sin^2 x}{\cos^2 x} + 1 = \frac{\sin^2 x}{\cos^2 x} + \frac{\cos^2 x}{\cos^2 x} = \frac{\sin^2 x + \cos^2 x}{\cos^2 x} = \frac{1}{\cos^2 x} = \text{RHS}$$

13.) $2 \sin^{-1}\left(\frac{10}{35}\right) \approx 33.2031^\circ$ 14.) $A = 22\sqrt{26} \text{ m}^2 \approx 112.17843 \text{ m}^2$ 15.) a) $2\sqrt{2}$ b) $\frac{1}{\sqrt{5}}$

16.) a) 5 b) $\frac{1}{3}e^2 + \frac{1}{3}$ c) 2186 d) 6565 e) $e^{-3} + 1$ f) 2 g) $-\frac{1}{2}$ h) $\frac{1}{3}\sqrt{e} - \frac{1}{3}$ i) 1

17.) a) -1 b) 12 c) $\frac{1}{2}(1 + \log_3 10)$ d) $\frac{1}{3}(1 + \ln 10)$ e) no solution f) 8 g) -1 h)

$\frac{1}{5}$ 18.) $\frac{A_1}{A_2} = \frac{9}{16}$ 19.) $(x-5)^2 + (y+1)^2 = 20$

20.) 74.77% 21.) $\tan^{-1}\left(\frac{\sqrt{238}}{9}\right) \approx 59.7414247^\circ$