

If you can solve nearly all of the following problems with little difficulty *without a calculator*, then the text **Precalculus** would only serve as a review for you.

1. What is the value of $\tan 75^\circ$?
2. Simplify $\cos(12^\circ) \cos(24^\circ) \cos(48^\circ) \cos(96^\circ)$.
3. Let $n \geq 3$ be a positive integer, and let $P_0P_1 \cdots P_{n-1}$ be a regular n -gon inscribed in a circle with radius 1. Compute $P_0P_1 \cdot P_0P_2 \cdot P_0P_3 \cdots P_0P_{n-1}$ in terms of n .
4. What is the value of $\cos^2 10^\circ + \cos^2 50^\circ - \sin 40^\circ \sin 80^\circ$?
5. Find the roots of $z^6 + z^4 + z^2 + 1$.
6. Suppose $\frac{\cos 3x}{\cos x} = \frac{1}{3}$ for some angle x , $0 \leq x \leq \frac{\pi}{2}$. Determine $\frac{\sin 3x}{\sin x}$ for the same x .
7. Find the volume of the tetrahedron with vertices $(-1, 3, 0)$, $(2, 1, 7)$, $(-4, 3, 2)$, $(3, 1, -2)$.
8. A sequence $(a_1, b_1), (a_2, b_2), (a_3, b_3), \dots$ of points in the coordinate plane satisfies

$$(a_{n+1}, b_{n+1}) = (\sqrt{3}a_n - b_n, \sqrt{3}b_n + a_n)$$

for all positive integers n . Suppose that $(a_{100}, b_{100}) = (2, 4)$. What is $a_1 + b_1$?

9. Find $\text{Im}((\cos 12^\circ + i \sin 12^\circ + \cos 48^\circ + i \sin 48^\circ)^6)$.
10. Evaluate $\sin 10^\circ \sin 20^\circ \sin 30^\circ \cdots \sin 170^\circ$.



The answers to Do You Know Precalculus are below. (The solutions in the text and the solutions manual include detailed explanations, as opposed to the mere answers provided below.)

1. $2 + \sqrt{3}$
2. $-\frac{1}{16}$
3. n
4. $\frac{3}{4}$
5. $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i, i, -\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i, -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i, -i, \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i$
6. $\frac{7}{3}$
7. $25/3$
8. $1/2^{98}$
9. 0
10. $\frac{9}{65536}$