

This diagnostic test is intended to assess the student's readiness for the **AP Calculus BC** class. Students enrolling in Calculus should be very comfortable with algebra (including complex numbers and logarithms), geometry (including analytic geometry), and trigonometry. If you can solve most of the problems on this test **without the use of a calculator** with little or no difficulty, then you are ready for the AP Calculus BC class. If you find these problems difficult, we suggest that you take the Precalculus class first.

## Algebra

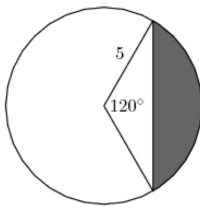
1. Expand  $(x + 2y)^3$ .
2. Find the sum and the product of the roots (real and complex) of  $3x^2 + 7x - 11 = 0$ .
3. Solve for  $x$ :

$$\frac{3}{x-2} + \frac{2}{x+2} = \frac{5}{x^2-4}$$

4. If Susan can paint a living room in 5 hours, and John can paint the same living room in 4 hours, then how long will it take them to paint the living room working together?
5. Determine the sum of the infinite geometric series with first term 3 and common ratio  $\frac{2}{5}$ .
6. Compute  $\log_9 27$ .
7. Factor completely  $x^6 - 1$  over the real numbers.

## Geometry and Analytic Geometry

1. Find the equation of the line passing through the points  $(2, 3)$  and  $(5, 1)$ .
2. Find the area of the shaded region below (lying inside a circle of radius 5):



3. Find the area of the region bordered by the lines  $4x + 7y = 14$ ,  $x = 1$ , and  $y = 2$ .
4. Sketch the graph of the equation

$$x^2 + y^2 + 2x + 4y = 11.$$

## Trigonometry

1. Evaluate the following quantities:

(a)  $\sin\left(\frac{\pi}{4}\right)$

(b)  $\cos\left(\frac{\pi}{2}\right)$

(c)  $\tan\left(\frac{2\pi}{4}\right)$

2. Find all  $\theta$  with  $0 \leq \theta \leq 2\pi$  such that:

$$(\sin\theta + \cos\theta)^2 = \frac{3}{2}$$

3. Sketch the graph of  $y = 3\sin(2x + 1)$ .

4. Simplify  $(\cos(\frac{\pi}{12}) + i \sin(\frac{\pi}{12}))^9$ .

## Answer Key

### Algebra

1.  $x^3 + 6x^2y + 12xy^2 + 8y^3$
2. Sum:  $\frac{-7}{3}$ , Product:  $\frac{-11}{3}$
3.  $x = \frac{3}{5}$
4.  $\frac{20}{9}$  hours
5. 5
6.  $\frac{3}{2}$
7.  $(x - 1)(x + 1)(x^2 + x + 1)(x^2 - x + 1)$

### Geometry and Analytic Geometry

1.

$$(y - 3) = \frac{-2}{3}(x - 2)$$

or

$$y = \frac{-2}{3}x + \frac{13}{3}$$

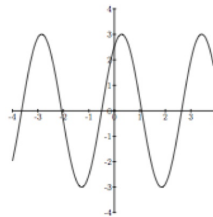
or

$$2x + 3y = 13$$

2.  $\frac{25}{3}\pi - \frac{25\sqrt{3}}{4}$
3.  $\frac{2}{7}$
4. Circle with center  $(-1, -2)$  and radius 4

### Trigonometry

1. (a)  $\frac{\sqrt{2}}{2}$ ; (b) 0; (c)  $\infty$
2.  $\theta \in \left\{ \frac{\pi}{12}, \frac{5\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12} \right\}$
3. The key features are passing through  $(\frac{1}{2}, 0)$  when crossing the x-axis at periods of every  $\frac{\pi}{2}$ , and



having an amplitude (height) of 3.

4.  $\frac{-\sqrt{2}}{2} + i\frac{\sqrt{2}}{2}$