

## Algebra and Trigonometry Challenge Exam Review Sheet

### Rules For All Challenge Exams

- All students may take a Challenge Exam to place out of College Algebra or Algebra & Trigonometry. Students who receive a grade of 70% or better on the Challenge Exam will receive a waiver (no credit given) for College Algebra or Algebra & Trigonometry.
- Time allotment: Students will have 90 minutes to complete the actual challenge exam.
- A student may take only one of the exams at a time. For example, if your program requires you to take MTH 120 (College Algebra) **and** MTH 220 (Algebra & Trigonometry) you may take only one of these exams during orientation. If you pass the Algebra & Trigonometry Challenge Exam then you are waived from taking both courses. If you take and pass the College Algebra Challenge Exam then you are waived from taking College Algebra but not Algebra & Trigonometry. You can then arrange to take the Algebra & Trigonometry Challenge Exam at a later date.
- Calculator Restrictions: Only certain types of calculators may be used during the test. Most four-function, scientific or graphing calculators are permitted. Devices that include calculators among their functions-cell phones, laptops, PDAs-are forbidden, as are calculators with built-in algebra capabilities or QWERTY keyboard buttons. Also, certain specific models of calculators are forbidden, including the following: all Texas Instruments model numbers that begin with TI-89 and TI-92, as well as the TI-Nspire CAS (the non-CAS TI-Nspire is allowed); the Hewlett-Packard hp 48GII model and all model numbers that begin with hp 40G, hp 49G, or hp 50G; the Casio Algebra fx 2.0, ClassPad 300, and all model numbers that begin with CFX-9970G; and all electronic writing pads or pen-input devices, except for the Sharp EL 9600.
- The review sheets provide **examples** from the topics that you will encounter on the actual exams. They are not specific examples from the exam.

# Example Problems for the Algebra & Trigonometry Challenge Exam

## 1. Topic: Circles

Example: Consider the circle which is the graph of the equation  $(x + 5)^2 + (y - 3)^2 = 64$ .

- (a) Find the coordinates of its center.
- (b) Find its radius.
- (c) Does the point  $(1, 8)$  lie on the circle.

Answers:            a)  $(-5, 3)$             b) 8            c) No.

## 2. Topic: Lines

Example: Find the equation of the line which

- (a) has slope 3 and  $y$ -intercept -5.
- (b) passes through the points  $(7, -2)$  and  $(3, 6)$ .

Answers:            a)  $y = 3x - 5$             b)  $y = -2x + 12$

## 3. Topic: Parabolas

Example: Consider the parabola which is the graph of the equation  $y = -2x^2 + 12x - 16$

- (a) Does the parabola open upward or downward?
- (b) Find the coordinates of its vertex.

Answers:            a) downward            b)  $(3, 2)$

## 4. Topic: Functions

Example: Consider the function  $f(x) = \sqrt{x - 4}$

- (a) Find  $f(13)$ .
- (b) Find the domain of  $f$ .

Answers:            a) 3            b)  $\{x|x \geq 4\}$

### 5. Topic: Composite Functions

Example: Let  $f(x) = 10 - 3x$  and  $g(x) = x^2 + 1$ . Find and simplify

(a)  $f(g(x))$

(b)  $g(f(x))$

Answers:            a)  $7 - 3x^2$             b)  $9x^2 - 60x + 101$

### 6. Topic: Variation

Example: Assume that  $y$  varies directly as the square root of  $x$  and inversely as  $z$ . Additionally, you are given that  $y = 12$  when  $x = 100$  and  $z = 50$ . Find  $y$  when  $x = 36$  and  $z = 4$ .

Answer:  $y = 90$ .

### 7. Topic: Inverse Functions

Example: Find the inverse of  $2x^5 - 3$ .

Answer:  $f^{-1}(x) = \sqrt[5]{\frac{x+3}{2}}$

### 8. Topic: Logarithms

Example: Find the following.

a)  $\log_3 81$             b)  $\log_2 \frac{1}{32}$             c)  $\log_k \sqrt[3]{k}$             d)  $\ln e^{10}$

Answers:            a) 4            b) -5            c)  $\frac{1}{3}$             d) 10

### 9. Topic: Properties of Logarithms

Example: If  $\log_a M = 6$ ,  $\log_a N = 5$ , and  $\log_a P = 4$ , find  $\log_a \left( \frac{M^2 N}{P} \right)$

Answer: 13.

### 10. Topic: Matrix Multiplication

Example: Find  $A \cdot B$  when

$$A = \begin{pmatrix} 6 & 3 & -1 \\ -4 & 5 & 0 \\ 2 & -3 & 8 \\ 1 & 4 & 2 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 5 & 4 \\ -2 & 3 \\ -6 & 1 \end{pmatrix} \quad \text{Answer} \quad A \cdot B = \begin{pmatrix} 30 & 32 \\ -30 & 1 \\ -32 & 7 \\ -15 & 8 \end{pmatrix}$$

11. **Topic: Gaussian or Gauss-Jordan Elimination**

Example: Consider the system of linear equations

$$\begin{aligned} 7x - 2y &= 25 \\ 3x + 5y &= -1 \end{aligned}$$

- (a) Write the augmented matrix of the system.
- (b) Solve the system using Gaussian or Gauss-Jordan elimination.

Answers:      a)  $\left( \begin{array}{ccc|c} 7 & -2 & 25 & \\ 3 & 5 & -1 & \end{array} \right)$       b)  $x = 3$  and  $y = -2$ .

12. **Topic: Cramer's Rule**

Example: Use Cramer's Rule (use determinants) to solve for  $x$  only.

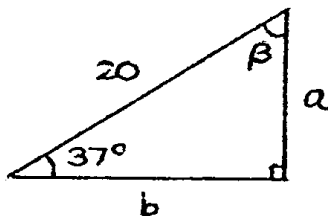
$$\begin{aligned} 3x - 5y + 2z &= 27 \\ 2x + y - 5z &= 3 \\ 4x + 3y - 6z &= 8 \end{aligned}$$

Answer:  $x = 5$

13. **Topic: Right triangle trigonometry**

Example: Find  $\beta$ ,  $a$ , and  $b$

Answers:  
 $\beta = 53^\circ$ ,     $a = 12.04$ ,     $b = 15.97$



14. **Topic: Trigonometric Values**

Example: Find the exact value of the following

- a)  $\cos \frac{2\pi}{3}$
- b)  $\sin \frac{7\pi}{4}$
- c)  $\tan \frac{\pi}{3}$

Answers:      a)  $-\frac{1}{2}$       b)  $-\frac{\sqrt{2}}{2}$       d)  $\sqrt{3}$

15. **Topic: Trigonometric Properties**

Example:  $\alpha$  is an angle in standard position with terminal side in Quadrant IV, and  $\cos \alpha = \frac{35}{37}$ . Find the exact value of  $\sin \alpha$ .

Answer:  $\sin \alpha = -\frac{12}{37}$

16. **Applications of right triangle trigonometry**

Example: Find the value of  $x$  in the diagram.

Answer:  
 $x = 59.6$

