

Key

Topic 1: Exponent Properties / Simplifying Radicals

DIRECTIONS: Simplify the following WITHOUT a calculator.

1. $(-2^2)^3$ $(-4)^3 = \boxed{-64}$	2. $-\left(\frac{2}{5}\right)^{-2}$ $-\left(\frac{5}{2}\right)^2 = \boxed{-\frac{25}{4}}$	3. $(3x^2y)^3$ $\boxed{27x^6y^3}$
4. $\frac{y^8}{5y^{10}}$ $\boxed{\frac{1}{5y^2}}$	5. $\frac{x^3y}{xy^2}$ $\boxed{\frac{x^2}{y}}$	6. $\frac{3xy^9}{2y^2} \cdot \frac{-7y}{42x^5}$ $\frac{3xy^7}{2} \cdot \frac{-y}{6x^5} = \boxed{\frac{-y^8}{4x^4}}$
7. $8^{\frac{2}{3}}$ $\sqrt[3]{8^2} = \sqrt[3]{64} = \boxed{4}$	8. $4^{\frac{-1}{2}}$ $= \frac{1}{\sqrt{4}} = \boxed{\frac{1}{2}}$	9. $(\sqrt[4]{16})^2$ $(2)^2 = \boxed{4}$
10. $\sqrt[3]{1000^2}$ $= 10^2 = \boxed{100}$	11. $(\sqrt[3]{-27})^{-4}$ $= (-3)^{-4} = \frac{1}{(-3)^4} = \boxed{\frac{1}{81}}$	12. $-(25^{\frac{-3}{2}})$ $= \frac{-1}{(\sqrt{25})^3} = \frac{-1}{5^3} = \boxed{\frac{-1}{125}}$
13. $\sqrt{80}$ $= \sqrt{16} \cdot \sqrt{5}$ $= \boxed{4\sqrt{5}}$	14. $\sqrt{32}$ $= \sqrt{16} \cdot \sqrt{2}$ $= \boxed{4\sqrt{2}}$	15. $\sqrt[3]{54x^3}$ $= \sqrt[3]{27} \cdot \sqrt[3]{2} \cdot \sqrt[3]{x^3}$ $= \boxed{3x\sqrt[3]{2}}$

16. $\sqrt{\frac{1}{4}}$ $= \frac{\sqrt{1}}{\sqrt{4}} = \boxed{\frac{1}{2}}$	17. $\sqrt{\frac{4}{75}}$ $= \frac{2}{\sqrt{75}} = \frac{2}{\sqrt{25} \sqrt{3}} = \boxed{\frac{2}{5\sqrt{3}}}$ $\frac{2}{5\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{5 \cdot 3} = \boxed{\frac{2\sqrt{3}}{15}}$	18. $4\sqrt{3} \cdot \sqrt{21}$ $= 4\sqrt{63}$ $= 4\sqrt{9 \cdot 7}$ $= 4 \cdot 3\sqrt{7}$ $= \boxed{12\sqrt{7}}$
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Topic 2: Factoring

DIRECTIONS: Factor each of the following by GCF (Greatest Common Factor)

1. $3x^4 - 9x^2$ $3x^2(x^2 - 3)$	2. $49xy + 28x - 14y$ $7(7xy + 4x - 2y)$	3. $18x^3y^5 - 12xy^2$ $6xy^2(3x^2y^3 - 2)$
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DIRECTIONS: Factor each quadratic Expression

4. $x^2 - 3x + 2$ $= (x-2)(x-1)$	5. $x^2 + 5x - 6$ $= (x+6)(x-1)$	6. $2x^2 + 5x - 3$ $= (2x-1)(x+3)$
7. $3x^2 - 8x + 4$ $= (3x-2)(x-2)$	8. $3x^2 + 17x + 10$ $= (3x+2)(x+5)$	9. $10x^2 - 19x + 6$ $= (5x-2)(2x-3)$

DIRECTIONS: Factor each special case.

Difference of Two Squares: $a^2 - b^2 = (a+b)(a-b)$

10. $x^2 - 144$ $= (x-12)(x+12)$	11. $9x^2 - 16$ $= (3x-4)(3x+4)$	12. $81x^2 - 25y^2$ $= (9x-5y)(9x+5y)$
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Perfect Square Trinomials: $a^2 + 2ab + b^2 = (a+b)^2$ and $a^2 - 2ab + b^2 = (a-b)^2$

13. $x^2 + 6x + 9$ $= (x+3)(x+3)$ $= (x+3)^2$	14. $4x^2 - 4x + 1$ $= (2x-1)(2x-1)$ $= (2x-1)^2$	15. $25x^2 - 30x + 9$ $= (5x-3)(5x-3)$ $= (5x-3)^2$
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same opp. always +

Sum/Difference of Two Cubes: $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ and $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

16. $x^3 - 8 = (x^3 - (2)^3)$ $= (x-2)(x^2 + 2x + 4)$	17. $125x^3 + y^3 = ((5x)^3 + y^3)$ $= (5x+y)(25x^2 - 5xy + y^2)$	18. $27y^6 - 64 = ((3y^2)^3 - 4^3)$ $= (3y^2-4)(9y^4 + 12y^2 + 16)$
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DIRECTIONS: Use synthetic division to factor as indicated.

19. $x^3 - 4x^2 + 2x + 1 = (x-1)(x^2 - 3x - 1)$ $\begin{array}{r rrrr} 1 & 1 & -4 & 2 & 1 \\ & \downarrow & 1 & -3 & \\ \hline & 1 & -3 & -1 & 0 \end{array}$ $\boxed{x^2 - 3x - 1}$	20. $2x^3 + 5x + 7 = (x+1)(2x^2 - 2x + 7)$ $\begin{array}{r rrrr} -1 & 2 & 0 & 5 & 7 \\ & \downarrow & -2 & 2 & \\ \hline & 2 & -2 & 7 & 0 \end{array}$ $\boxed{2x^2 - 2x + 7}$
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21. $x^4 - 3x^3 + x^2 + x + 2 = (x-2)(x-x-x-1)$

$$\begin{array}{r|rrrrr} 2 & 1 & -3 & 1 & 1 & 2 \\ & \downarrow & 2 & -2 & -2 & -2 \\ \hline & 1 & -1 & -1 & -1 & 0 \end{array}$$

$$= x^3 - x^2 - x - 1$$

22. $4x^4 + 3x^2 - 1 = (2x-1)(2x+x^2+2x+1)$

$$\begin{array}{r} 2x-1 \overline{) 4x^4 + 0x^3 + 3x^2 + 0x - 1} \\ \underline{-4x^4 - 2x^3} \\ 0 + 2x^3 + 3x^2 \\ \underline{-2x^3 - x^2} \\ 4x^2 + 0x \\ \underline{-4x^2 - 2x} \\ 2x - 1 \\ \underline{-2x - 1} \\ 0 \end{array}$$

Topic 3: Solving Equations and Inequalities

DIRECTIONS: Solve for the unknown variable.

1. $\frac{2x+1}{5} = \frac{3x+1}{2}$

$$\begin{aligned} 2(2x+1) &= 5(3x+1) \\ 4x+2 &= 15x+5 \\ -11x &= 3 \end{aligned}$$

$$x = \frac{-3}{11}$$

2. $\left(\frac{x}{2} + \frac{5x}{6} = \frac{2x}{3} + \frac{1}{12}\right)^{12}$

$$\begin{aligned} 6x + 10x &= 8x + 1 \\ 8x &= 1 \\ x &= \frac{1}{8} \end{aligned}$$

3. $4x + 3(x-8) = 5x - (x+7)$

$$\begin{aligned} 4x + 3x - 24 &= 5x - x - 7 \\ 7x - 24 &= 4x - 7 \\ 3x &= 17 \end{aligned}$$

$$x = \frac{17}{3}$$

DIRECTIONS: Solve each quadratic for the unknown variable.

4. $4x^2 - 81 = 0$

$$\begin{aligned} 4x^2 &= 81 \\ \sqrt{x^2} &= \sqrt{\frac{81}{4}} \end{aligned}$$

$$x = \pm \frac{9}{2}$$

5. $8x^2 - 5 = 6x$

$$\begin{aligned} 8x^2 - 6x - 5 &= 0 \\ (4x-5)(2x+1) &= 0 \end{aligned}$$

$$4x-5=0 \quad 2x+1=0$$

$$x = \frac{5}{4} \quad x = -\frac{1}{2}$$

6. $6x^2 + 7x + 5 = 0$

$$x = \frac{-7 \pm \sqrt{7^2 - 4(6)(5)}}{2(6)}$$

$$= \frac{-7 \pm \sqrt{-71}}{12}$$

$$= \frac{-7 \pm i\sqrt{71}}{12}$$

DIRECTIONS: Solve each radical equation.

7. $(\sqrt{x})^2 = (3x-1)^2$ $x = (3x-1)(3x-1)$ $x = 9x^2 - 6x + 1$ $0 = 9x^2 - 7x + 1$ $x = \frac{7 \pm \sqrt{7^2 - 4(9)(1)}}{2(9)} = \frac{7 \pm \sqrt{13}}{18}$	8. $1 + 3\sqrt{2x} = 7$ $3\sqrt{2x} = 6$ $(\sqrt{2x})^2 = (2)^2$ $2x = 4$ $x = 2$ $1 + 3\sqrt{4}$ $1 + 3(2)$ $1 + 6$ $= 7 \checkmark$	9. $(\sqrt{2x-10})^2 = (\sqrt{8-x})^2$ $2x-10 = 8-x$ $3x = 18$ $x = 6$ $\sqrt{12-10} = \sqrt{8-6}$ $\sqrt{2} = \sqrt{2} \checkmark$
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DIRECTIONS: Solve each rational equation.

10. $\frac{3}{2x} - \frac{9}{2} = 6x$ $\frac{3}{2x} - \frac{9x}{2x} = 6x$ $\frac{3-9x}{2x} = 6x$ $3-9x = 12x^2$ $0 = 12x^2 + 9x - 3$ $0 = 3(4x^2 + 3x - 1)$ $0 = 3(4x-1)(x+1)$ $x = \frac{1}{4}, -1$	11. $\frac{2}{3x} + \frac{2}{3} = \frac{8}{x+6}$ $\frac{2+2x}{3x} = \frac{8}{x+6}$ $(2+2x)(x+6) = 24x$ $2x+12+2x^2+12x = 24x$ $2x^2-10x+12 = 0$ $2(x^2-5x+6) = 0$ $2(x-3)(x-2) = 0$ $x = 3, 2$	12. $\frac{2}{x+1} + \frac{x}{x-1} = \frac{2}{x^2-1}$ $\frac{2(x-1) + x(x+1)}{(x+1)(x-1)} = \frac{2}{x^2-1}$ $2(x-1) + x(x+1) = 2$ $2x-2 + x^2 + x = 2$ $x^2 + 3x - 4 = 0$ $(x+4)(x-1) = 0$ $x = -4, 1$
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Topic 4: Functions

DIRECTIONS: Evaluate the following. (function notation)

Given $f(x) = -x^2 + x$, find the following.		
1. $f(0)$ $= -0^2 + 0$ $= 0$	2. $f(-\frac{1}{3})$ $= -(-\frac{1}{3})^2 + (-\frac{1}{3}) = -\frac{1}{9} - \frac{1}{3}$ $= -\frac{1}{9} - \frac{3}{9} = -\frac{4}{9}$	3. Find x when $f(x) = 0$ $0 = -x^2 + x$ $0 = x(-x+1)$ $x = 0$ or $x = 1$

DIRECTIONS: Evaluate the following. (function notation)

Given $f(x) = \frac{x}{3} + \frac{7}{4}$, find the following.

4. Find the x and y intercepts of $f(x)$. $f(0) = \frac{0}{3} + \frac{7}{4} = \frac{7}{4}$ y-int $0 = \frac{x}{3} + \frac{7}{4}$ $-\frac{7}{4} = \frac{x}{3}$ $-\frac{21}{4} = x$ x-int.	5. Find x, when $f(x) = \frac{1}{8}$ $\frac{1}{8} = \frac{x}{3} + \frac{7}{4}$ $-\frac{13}{8} = \frac{x}{3}$ $-\frac{39}{8} = x$	6. $f(\frac{-9}{8})$ $\frac{-\frac{9}{8}}{3} + \frac{7}{4} = \frac{-3}{8} + \frac{7}{4}$ $= \frac{-3}{8} + \frac{14}{8} = \frac{11}{8}$ $\frac{11}{8}$
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DIRECTIONS: Perform the following function operations.

Given the functions $f(x) = 2x^2$ and $g(x) = 3 - 4x$, find the following.		
7. $f(g(x))$ $f(3-4x) = 2(3-4x)^2$ $2(3-4x)(3-4x)$ $= 2(9-24x+16x^2)$ $= 32x^2 - 48x + 18$	8. $g(f(x))$ $g(2x^2) = 3 - 4(2x^2)$ $= 3 - 8x^2$	9. $(f - g)(x)$ $2x^2 - (3 - 4x)$ $2x^2 - 3 + 4x$ $= 2x^2 + 4x - 3$
10. $f(f(x))$ $f(2x^2) = 2(2x^2)^2$ $= 2(4x^4) = 8x^4$	11. $g(g(x))$ $g(3-4x) = 3 - 4(3-4x)$ $= 3 - 12 + 16x$ $= 16x - 9$	12. $fg(x)$ $2x^2(3-4x)$ $= 6x^2 - 8x^3$

DIRECTIONS: Match the function with its name.

C

1. $f(x) = \frac{2}{3}|4x+5|-3$

E

2. $f(x) = \frac{2}{3}\sqrt[3]{4x+5}-3$

G

3. $f(x) = \frac{2}{3} \cdot \frac{1}{4x+5}-3$

H

4. $f(x) = \frac{2}{3}(4x+5)^4 - 3(4x+5)^2 - 2$

D

5. $f(x) = \frac{2}{3}(4x+5)^3 - 3$

A

6. $f(x) = \frac{2}{3}(4x+5)-3$

B

7. $f(x) = \frac{2}{3}(4x+5)^2 - 3$

F

8. $f(x) = \frac{2}{3}\sqrt{4x+5}-3$

A. Linear Function

B. Quadratic Function

C. Absolute Value Function

D. Cubic Function

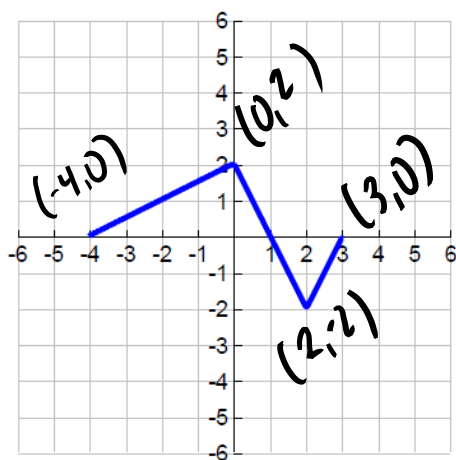
E. Cube Root Function

F. Square Root Function

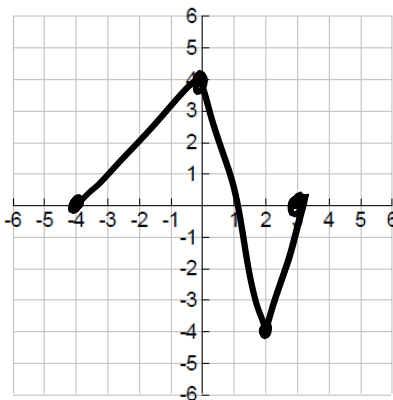
G. Rational Function

H. Polynomial Function

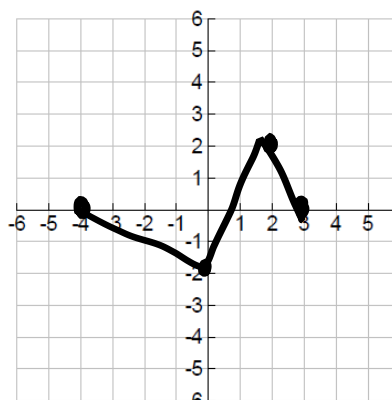
DIRECTIONS: Use the graph of $y = f(x)$ to below to sketch the following transformations.



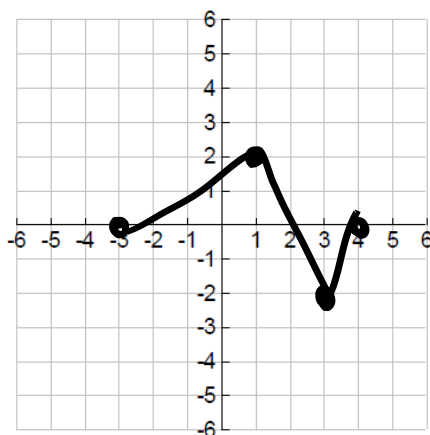
1. $y = 2f(x)$



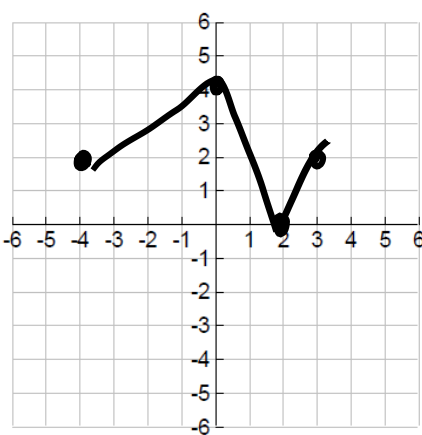
2. $y = -f(x)$



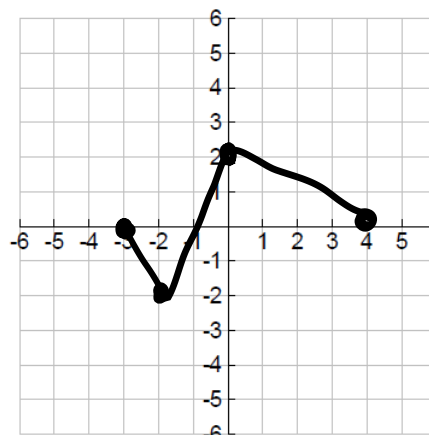
3. $y = f(x-1)$



4. $y = f(x) + 2$



5. $y = f(-x)$



Topic 5: Miscellaneous

DIRECTIONS: Find the distance and midpoint between the two points.

1. $(-2, 5); (6, -1)$ $d = \sqrt{(6+2)^2 + (-1-5)^2}$ $= \sqrt{8^2 + (-6)^2}$ $= \sqrt{100}$ $= 10$ $M = \left(\frac{-2+6}{2}, \frac{5-1}{2} \right)$ $= \left(\frac{4}{2}, \frac{4}{2} \right)$ $= (2, 2)$	2. $\left(\frac{3}{2}, -\frac{1}{2}\right); \left(-\frac{3}{2}, \frac{7}{2}\right)$ $d = \sqrt{\left(-\frac{3}{2} - \frac{3}{2}\right)^2 + \left(\frac{7}{2} - \left(-\frac{1}{2}\right)\right)^2}$ $= \sqrt{(-3)^2 + (4)^2}$ $= \sqrt{9+16} = \sqrt{25} = 5$ $M = \left(\frac{\frac{3}{2} - \frac{3}{2}}{2}, \frac{-\frac{1}{2} + \frac{7}{2}}{2} \right)$ $M = \left(\frac{0}{2}, \frac{3}{2} \right)$ $= (0, \frac{3}{2})$	3. $\left(\frac{5}{2}, -\frac{3}{2}\right); (1, -4)$ $d = \sqrt{\left(1 - \frac{5}{2}\right)^2 + \left(-4 - \left(-\frac{3}{2}\right)\right)^2}$ $= \sqrt{\left(-\frac{3}{2}\right)^2 + \left(-\frac{5}{2}\right)^2}$ $= \sqrt{\left(\frac{9}{4}\right) + \left(\frac{25}{4}\right)}$ $= \sqrt{\frac{34}{4}} = \frac{\sqrt{34}}{2}$ $M = \left(\frac{\frac{5}{2} + 1}{2}, \frac{-\frac{3}{2} - 4}{2} \right) = \left(\frac{7/2}{2}, \frac{-11/2}{2} \right)$ $= \left(\frac{7}{4}, -\frac{11}{4} \right)$
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DIRECTIONS: Find the equation of the line that has the given characteristics. Write the equation in any form.

4. slope = $\frac{3}{4}$ y-intercept = $-\frac{2}{3}$ $y = \frac{3}{4}x - \frac{2}{3}$	5. Parallel to $2x + 3y = 4$ through $(-3, 6)$ $m = -\frac{2}{3}$ $y - 6 = -\frac{2}{3}(x + 3)$	6. Perpendicular to $4x - 7y = 23$ through $(-2, 1)$ $m = \frac{4}{7}$ $y - 1 = \frac{4}{7}(x + 2)$
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Unit Circle – In Algebra 2, the focus was on degrees. This year, we will primarily use radians. It is beneficial to memorize the unit circle!

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$(\cos \theta, \sin \theta)$$

$(-, +)$

$(+, +)$

$$\begin{array}{l} \circ: 120^\circ \text{ rad: } \frac{2\pi}{3} \\ (-\frac{1}{2}, \frac{\sqrt{3}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 90^\circ \text{ rad: } \frac{\pi}{2} \\ (0, 1) \end{array}$$

$$\begin{array}{l} \circ: 60^\circ \text{ rad: } \frac{\pi}{3} \\ (\frac{1}{2}, \frac{\sqrt{3}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 135^\circ \text{ rad: } \frac{3\pi}{4} \\ (-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 45^\circ \text{ rad: } \frac{\pi}{4} \\ (\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 150^\circ \text{ rad: } \frac{5\pi}{6} \\ (-\frac{\sqrt{3}}{2}, \frac{1}{2}) \end{array}$$

$$\begin{array}{l} \circ: 30^\circ \text{ rad: } \frac{\pi}{6} \\ (\frac{\sqrt{3}}{2}, \frac{1}{2}) \end{array}$$

$$\begin{array}{l} \circ: 180^\circ \text{ rad: } \pi \\ (-1, 0) \end{array}$$

$$\begin{array}{l} \circ: 0^\circ \text{ rad: } 0 \\ (1, 0) \end{array}$$

$$\begin{array}{l} \circ: 210^\circ \text{ rad: } \frac{7\pi}{6} \\ (-\frac{\sqrt{3}}{2}, -\frac{1}{2}) \end{array}$$

$$\begin{array}{l} \circ: 330^\circ \text{ rad: } \frac{11\pi}{6} \\ (\frac{\sqrt{3}}{2}, -\frac{1}{2}) \end{array}$$

$$\begin{array}{l} \circ: 225^\circ \text{ rad: } \frac{5\pi}{4} \\ (-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 315^\circ \text{ rad: } \frac{7\pi}{4} \\ (\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 240^\circ \text{ rad: } \frac{4\pi}{3} \\ (-\frac{1}{2}, -\frac{\sqrt{3}}{2}) \end{array}$$

$$\begin{array}{l} \circ: 270^\circ \text{ rad: } \frac{3\pi}{2} \\ (0, -1) \end{array}$$

$$\begin{array}{l} \circ: 300^\circ \text{ rad: } \frac{5\pi}{3} \\ (\frac{1}{2}, -\frac{\sqrt{3}}{2}) \end{array}$$

$(-, -)$

$(+, -)$

S	A
T	C

where positive