

Name Key

Topic 1: Fractional & Negative Exponents

Simplify using only positive exponents

$$1. \frac{-3x^{-3} - 3}{x^3}$$

$$2. -5\left(\frac{3}{2}\right)(4-9x)^{-\frac{1}{2}}(-9)$$

$$3. 2\left(\frac{2}{2-x}\right)\left[\frac{-2}{(2-x)^2}\right]$$

$$\frac{135}{2\sqrt{4-9x}}$$

$$\frac{-8}{(2-x)^3}$$

$$4. (16x^2y)^{\frac{3}{4}}$$

$$8x^{\frac{3}{2}}y^{\frac{3}{4}}$$

$$5. -\frac{x^{-\frac{1}{2}}}{2}\sin\sqrt{x}$$

$$\frac{-\sin\sqrt{x}}{2\sqrt{x}}$$

$$6. \frac{\sqrt{4x-16}}{\sqrt[4]{(x-4)^3}}$$

$$\frac{2}{(x-4)^{\frac{1}{4}}}$$

$$7. -4\left(\frac{2x-1}{2x+1}\right)^{-3}\left[\frac{2(2x+1)-2(2x-1)}{(2x+1)^2}\right]$$

$$\frac{-16(2x+1)}{(2x-1)^3}$$

$$8. \frac{\frac{1}{2}(2x+5)^{-\frac{3}{2}}}{\frac{3}{2}}$$

$$\frac{1}{3(2x+5)^{\frac{3}{2}}}$$

$$9. \left(\frac{1}{x^{-2}} + \frac{4}{x^{-1}y^{-1}} + \frac{1}{y^{-2}}\right)^{-\frac{1}{2}}$$

$$\frac{1}{\sqrt{x^2 + 4xy + y^2}}$$

Topic 2: Domain

Find the domain of the following functions:

$$1. y = \frac{3x-2}{4x+1}$$

$$\mathbb{R}, x \neq -\frac{1}{4}$$

$$2. y = \frac{x^2-4}{2x+4}$$

$$\mathbb{R}, x \neq -2$$

$$3. y = \frac{x^2-5x-6}{x^2-3x-18}$$

$$\frac{(x-6)(x+1)}{(x-6)(x+3)}$$

$$\mathbb{R}, x \neq 6, -3$$

$$4. y = \frac{2^{2-x}}{x}$$

$$\mathbb{R}, x \neq 0$$

$$5. y = \sqrt{x-3} - \sqrt{x+3}$$

$$\mathbb{R}, x \geq 3$$

$$6. y = \frac{\sqrt{2x-9}}{2x+9}$$

$$x \geq \frac{9}{2}$$

$$7. y = \frac{x^2+8x+12}{\sqrt{x+5}}$$

$$x > -5$$

$$8. y = \sqrt{x^2-5x-14}$$

$$x \leq -2, x \geq 7$$

$$9. y = \frac{\sqrt[3]{x-6}}{\sqrt{x^2-x-30}}$$

$$x < -5, x > 6$$

$$10. y = \log(2x-12)$$

$$x > 6$$

$$11. y = \sqrt{\tan x}$$

$$\tan x \geq 0$$

$$x \geq \tan^{-1} 0$$

$$0 \leq x < \frac{\pi}{2}$$

$$12. y = \frac{x}{\cos x}$$

$$x \neq \frac{\pi}{2}, \frac{3\pi}{2}$$

$$\pm 2\pi k$$

$$x \neq \frac{\pi}{2} \pm \pi k$$

Topic 3: Solving inequalities (absolute value)

Write the following absolute value expressions as piecewise expressions

1. $y = |2x - 4|$

2. $y = |6 + 2x| + 1$

3. $y = |4x + 1| + 2x - 3$

$$f(x) = \begin{cases} 2x - 4, & x \geq 2 \\ -2x + 4, & x \leq 2 \end{cases}$$

$$f(x) = \begin{cases} 2x + 7, & x \geq -3 \\ -2x - 5, & x \leq -3 \end{cases}$$

$$f(x) = \begin{cases} 6x - 2 \\ -2x - 4 \end{cases}$$

Solve the following absolute value inequalities

4. $|x - 3| > 12$

5. $|x - 3| \leq 4$

6. $|10x + 8| > 2$

$$x - 3 > 12 \quad x - 3 < -12$$

$$x - 3 \leq 4 \quad x - 3 \geq -4$$

$$10x + 8 > 2 \quad 10x + 8 < -2$$

$$x > 15, \quad x < -9$$

$$x \leq 7, \quad x \geq -1$$

$$x > -\frac{3}{5} \quad x < -1$$

7. $|3x - 4| > -2$

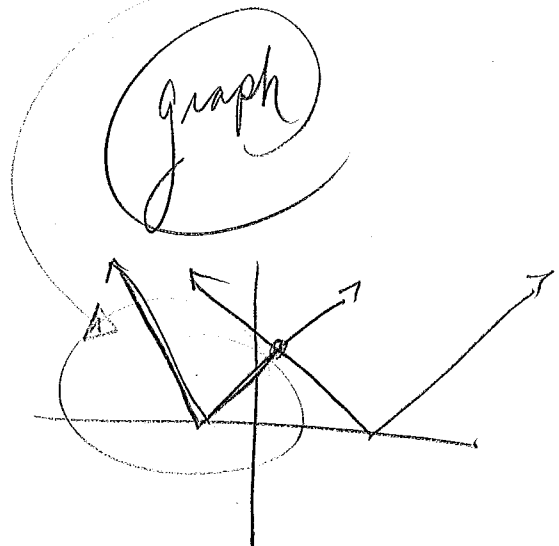
8. $|x - 6| > -8$

9. $|x + 1| \leq |x - 3|$

\mathbb{R}

\mathbb{R}

$$x \leq 1$$



Topic 4: Solving inequalities (quadratic)

Write the following absolute value expressions as piecewise expressions

1. $|x^2 - 1|$

2. $|x^2 + x - 12|$

3. $|x^2 + 4x + 4|$

$$\begin{cases} x^2 - 1, & x < -1, x > 1 \\ -x^2 + 1, & -1 \leq x \leq 1 \end{cases}$$

$$\begin{cases} x^2 + x - 12, & x < -4, x > 3 \\ -x^2 - x + 12, & -4 \leq x \leq 3 \end{cases}$$

$$x^2 + 4x + 4, \mathbb{R}$$

Solve the following by factoring and making appropriate sign charts.

4. $x^2 - 16 > 0$

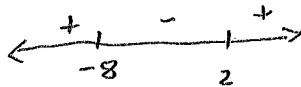
$$(x+4)(x-4)$$



$$x < -4, x > 4$$

5. $x^2 + 6x - 16 > 0$

$$(x+8)(x-2)$$

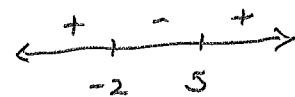


$$x < -8, x > 2$$

6. $x^2 - 3x \geq 10$

$$x^2 - 3x - 10 \geq 0$$

$$(x-5)(x+2) \geq 0$$



$$x \leq -2, x \geq 5$$

7. $2x^2 + 4x \leq 3$

$$2x^2 + 4x - 3 \leq 0$$

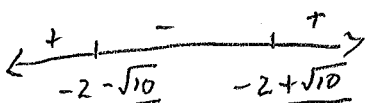
$$\frac{-4 \pm \sqrt{16 - 4(2)(-3)}}{2(2)}$$

$$\frac{-4 \pm \sqrt{40}}{4}$$

$$4$$

$$\frac{-2 \pm \sqrt{10}}{2}$$

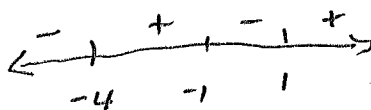
$$2$$



$$\left[\frac{-2 - \sqrt{10}}{2}, \frac{-2 + \sqrt{10}}{2} \right]$$

8. $x^3 + 4x^2 - x \geq 4$

$$(x+1)(x-1)(x+4) \geq 0$$

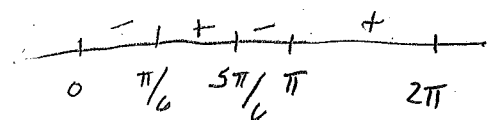


$$[-4, -1] \cup [1, \infty)$$

9. $2\sin^2 x \geq \sin x \quad 0 \leq x < 2\pi$

$$2\sin^2 x - \sin x \geq 0$$

$$\sin x (2\sin x - 1) \geq 0$$



$$\left[\frac{\pi}{6}, \frac{5\pi}{6} \right] \cup [\pi, 2\pi]$$

Topic 5: Special factorization

Factor completely

1. $x^3 + 8$

$$(x+2)(x^2 - 2x + 4)$$

2. $x^3 - 8$

$$(x-2)(x^2 + 2x + 4)$$

3. $27x^3 - 125y^3$

$$(3x - 5y)(9x^2 + 15xy + 25y^2)$$

4. $x^4 + 11x^2 - 80$

$$(x^2 + 16)(x^2 - 5)$$

5. $ac + cd - ab - bd$

$$c(a+d) - b(a+d)$$

$$(a+d)(c-b)$$

6. $2x^2 + 50y^2 - 20xy$

$$2(x-5y)(x+5y)$$

7. $x^2 + 12x + 36 - 9y^2$

$$(x+6)^2 - 9y^2$$

$$[(x+6) + 3y][(x+6) - 3y]$$

8. $x^3 - xy^2 + x^2y - y^3$

$$(x+y)^2(x-y)$$

9. $(x-3)^2(2x+1)^3 + (x-3)^3(2x+1)^2$

$$(x-3)^2(2x+1)^2 [(2x+1) + (x-3)]$$

$$(x-3)^2(2x+1)^2(3x-2)$$

Topic 6: Function transformation

If $f(x) = x^2 - 1$, describe in words what the following would do to the graph of $f(x)$:

1. $f(x) - 4$
down 4

2. $f(x - 4)$
4 right

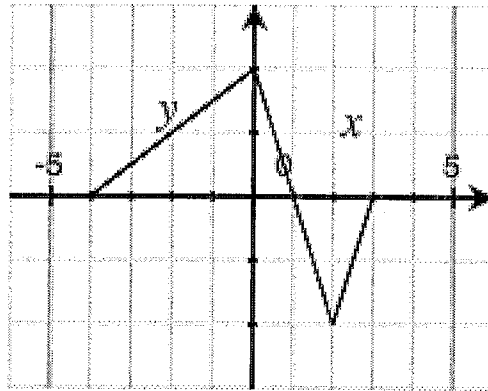
3. $-f(x + 2)$
2 left; flipped upside down

4. $5f(x) + 3$
up 3, stretch vert

5. $f(2x)$
shrinks horiz.

6. $|f(x)|$
reflects neg. over x-axis

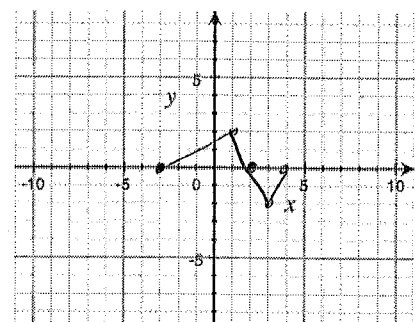
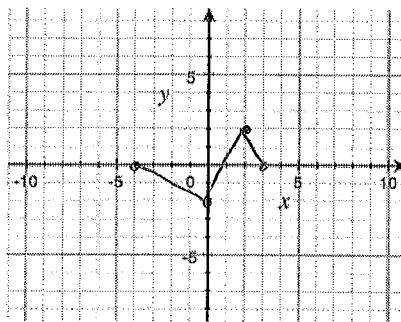
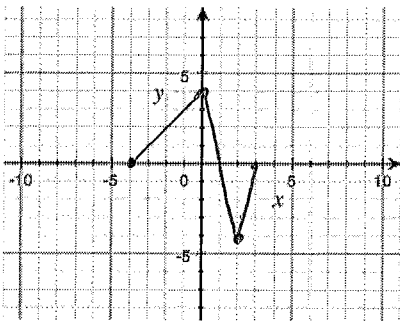
Here is a graph of $y = f(x)$. Sketch the following graphs



7. $y = 2f(x)$

8. $y = -f(x)$

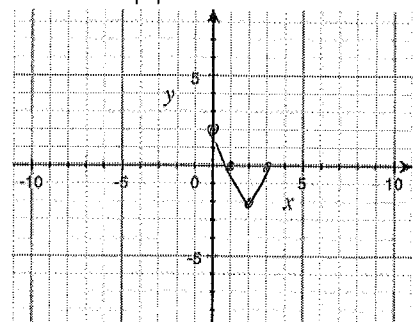
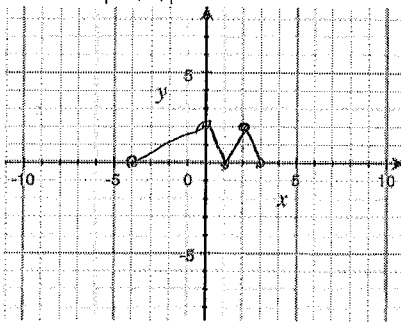
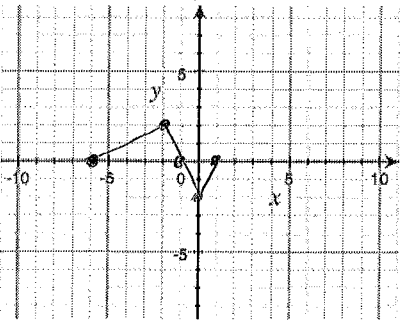
9. $y = f(x - 1)$



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

11. $y = |f(x)|$

12. $y = f|x|$



Topic 7: Factor theorem (p over q method/synthetic division)

Use the p over q method and synthetic division to factor the polynomial $P(x)$. Then solve $P(x) = 0$.

1. $P(x) = x^3 + 4x^2 + x - 6$

$$x = -3, -2, 1$$

2. $P(x) = x^3 + 5x^2 - 2x - 24$

$$x = 2, -3, -4$$

3. $P(x) = x^3 - 6x^2 + 3x - 10$

none

4. $P(x) = x^3 + 2x^2 - 19x - 20$

$$x = 5, -1, 4$$

5. $P(x) = x^4 + 5x^3 + 6x^2 - 4x - 8$

$$x = -2, 1$$

6. $P(x) = x^4 + 11x^3 + 41x^2 + 61x + 30$

$$x = -5, -3, -2, -1$$

Topic 8: Even and odd functions

Show work to determine if the relation is even, odd, or neither

1. $f(x) = 2x^2 - 7$

Even; $f(x) = f(-x)$

$$2x^2 - 7 = 2(-x)^2 - 7$$

2. $f(x) = -4x^3 - 2x$

Odd; $f(-x) = -f(x)$

$$-4(-x)^3 - 2(-x) = -(-4x^3 - 2x)$$

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

Neither

4. $f(x) = x - \frac{1}{x}$

Odd; $f(-x) = -f(x)$

$$(-x) - \frac{1}{(-x)} = -(x - \frac{1}{x})$$

5. $f(x) = |x| - x^2 + 1$

Even; $f(x) = f(-x)$

6. $5x^2 - 6y = 1$

Neither

7. $y = e^x - \frac{1}{e^x}$

odd; $f(-x) = -f(x)$

$$e^{-x} - \frac{1}{e^{-x}} = -e^x + \frac{1}{e^x}$$

↓

$$\frac{1}{e^x} - e^x = -e^x + \frac{1}{e^x}$$

8. $3y^3 = 4x^3 + 1$

Neither

9. $3x = |y|$

Neither

Topic 9: Solving quadratic equations and quadratic formula

Solve each equation

1. $7x^2 - 3x = 0$

$$x(7x - 3) = 0$$

$$x = 0, x = \frac{3}{7}$$

2. $4x(x-2) - 5x(x-1) = 2$

$$4x^2 - 8x - 5x^2 + 5x - 2 = 0$$

$$-x^2 - 3x - 2 = 0$$

$$-(x^2 + 3x + 2) = 0$$

$$-(x+2)(x+1) = 0$$

$$x = -2, -1$$

3. $x^2 + 6x + 4 = 0$

$$\frac{-6 \pm \sqrt{36 - 4(1)(4)}}{2(1)}$$

$$\frac{-6 \pm \sqrt{20}}{2}$$

$$x = -3 \pm \sqrt{5}$$

4. $2x^2 - 3x + 3 = 0$

$$\frac{3 \pm \sqrt{9 - 4(2)(3)}}{2(2)}$$

$$\frac{3 \pm \sqrt{-15}}{4}$$

$$\frac{3 \pm i\sqrt{15}}{4}$$

5. $2x^2 - (x+2)(x-3) = 12$

$$2x^2 - x^2 + x + 6 - 12 = 0$$

$$x^2 + x - 6 = 0$$

$$(x+3)(x-2) = 0$$

$$x = -3, 2$$

6. $x + \frac{1}{x} = \frac{13}{6}$

$$6x^2 + 6 = 13x$$

$$6x^2 - 13x + 6 = 0$$

$$(2x-3)(3x-2) = 0$$

$$x = \frac{3}{2}, \frac{2}{3}$$

7. $x^4 - 9x^2 + 8 = 0$

$$(x^2 - 8)(x^2 - 1) = 0$$

$$x = \pm 2\sqrt{2}, x = \pm 1$$

8. $x - 10\sqrt{x} + 9 = 0$

$$(\sqrt{x} - 9)(\sqrt{x} - 1) = 0$$

$$\sqrt{x} = 9 \quad \sqrt{x} = 1$$

$$x = 81, x = 1$$

9. $\frac{1}{x^2} - \frac{1}{x} = 6$

$$1 - x = 6x^2$$

$$6x^2 + x - 1 = 0$$

$$\frac{-1 \pm \sqrt{1 - 4(6)(-1)}}{2(6)}$$

$$\frac{-1 \pm \sqrt{25}}{12}$$

$$x = \frac{1}{3}, -\frac{1}{2}$$

$$(3x - 1)(2x + 1)$$

Topic 10: Asymptotes

For each function, find the equations of both the vertical asymptote(s) and horizontal asymptotes (if they exist)

$$1. y = \frac{x}{x-3}$$

$$\frac{V}{x=3} \quad \frac{H}{y=1}$$

$$2. y = \frac{x+4}{x^2-1}$$

$$\frac{V}{x=\pm 1} \quad \frac{H}{y=0}$$

$$3. y = \frac{x+4}{x^2+1}$$

$$\frac{V}{\text{None}} \quad \frac{H}{y=0}$$

$$4. y = \frac{x^2-2x+1}{x^2-3x-4}$$

$$y = \frac{(x-1)(x-1)}{(x-4)(x+1)}$$

$$\frac{V}{x=4, -1} \quad \frac{H}{y=1}$$

$$5. y = \frac{x^2-9}{x^3+3x^2-18x}$$

$$y = \frac{(x+3)(x-3)}{x(x+6)(x-3)}$$

$$\frac{V}{x=-6, x=0} \quad \frac{H}{y=0}$$

$$\frac{\text{Hole}}{x=3}$$

$$6. y = \frac{2x^2+6x}{x^3-3x^2-4x}$$

$$y = \frac{2x(x+3)}{x(x-4)(x+1)}$$

$$\frac{V}{x=0, 4, -1} \quad \frac{H}{y=0}$$

$$7. y = \frac{x^2-x-6}{x^3-x^2+x-6}$$

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

$$\frac{V}{x=2} \quad \frac{H}{y=0}$$

$$8. y = \frac{2x^3}{x^3-1}$$

$$\frac{V}{x=1} \quad \frac{H}{y=2}$$

$$9. y = \frac{\sqrt{x}}{2x^2-10}$$

$$\frac{V}{x=\pm\sqrt{5}} \quad \frac{H}{y=0}$$

$$\uparrow$$

$$x = \sqrt{5}$$

no neg
under $\sqrt{\quad}$

Topic 11: Complex fractions

Simplify the following

$$1. \frac{\frac{x}{x-\frac{1}{2}}}{\frac{2}{2}} = \frac{2x}{2x-1}$$

$$2. \frac{\frac{\frac{1}{x}+4}{\frac{1}{x}-2}}{x} = \frac{1+4x}{1-2x}$$

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

$$4. \frac{\frac{\frac{3}{x}-\frac{4}{y}}{\frac{4}{x}-\frac{3}{y}}}{xy} = \frac{3y-4x}{4y-3x}$$

$$5. \frac{\frac{1-\frac{2}{3x}}{x-\frac{4}{9x}}}{9x} = \frac{9x-6}{(3x+2)(3x-2)} = \frac{3}{3x+2}$$

$$6. \frac{\frac{\frac{x^2-y^2}{xy}}{\frac{x+y}{y}}}{xy} = \frac{x^2-y^2}{x(x+y)} = \frac{x-y}{x}$$

$$7. \frac{\frac{x^3-x}{x^2-1}}{\frac{\frac{1}{x^3}-x}{\frac{1}{x^2}-1}} = \frac{1-x^4}{x-x^3} = \frac{(1-x^2)(1+x^2)}{x(1-x^2)} = \frac{1+x^2}{x}$$

$$8. \frac{\frac{\frac{x}{1-x} + \frac{1+x}{x}}{\frac{1-x}{x} + \frac{x}{1+x}}}{x^2 + (1-x^2)} = \frac{1-x^2+x^2}{x(1-x)} = \frac{1}{x(1-x)} = \frac{1}{(1-x)}$$

$$9. \frac{\frac{\frac{4}{x-5} + \frac{2}{x+2}}{2x}}{x^2-3x-10} = \frac{4(x+2)+2(x-5)}{(x-5)(x+2)} = \frac{2x+3}{(x-5)(x+2)} = \frac{6x-2}{3x^2-7x-30}$$

Topic 12: Composition of functions

If $f(x) = x^2$, $g(x) = 2x - 1$, and $h(x) = 2^x$, find the following

1. $f(g(2))$
 $f[4-1] = f(3) = 9$

2.. $f(g(2))$

3. $f(h(-1))$
 $f[2^{-1}] = f\left(\frac{1}{2}\right) = \frac{1}{4}$

4. $h(f(-1))$
 $h[1] = 2^1 = 2$

5. $g\left(f\left(h\left(\frac{1}{2}\right)\right)\right)$
 $g[f(2^{-1/2})] = g[f[\sqrt{2}]]$
 $g[2] = 3$

6. $f(g(x))$
 $f[2x-1] =$
 $(2x-1)^2 = 4x^2 - 4x + 1$

7. $g(f(x))$
 $g[x^2] =$
 $2(x^2) - 1$
 $2x^2 - 1$

8. $g(g(x))$
 $g[2x-1] =$
 $(2(2x-1) - 1)$
 $4x - 2 - 1$
 $4x - 3$

9. $f(h(x))$
 $f[2^x] =$
 $(2^x)^2 = 2^{2x} = 4^x$

Topic 13: Solving Rational (fractional) equations

Solve each equation for x

$$1. \frac{2}{3} - \frac{5}{6} = \frac{1}{x} \quad \cdot 6x$$

$$4x - 5x = 6$$

$$-x = 6$$

$$x = -6$$

$$2. x + \frac{6}{x} = 5 \quad \cdot x$$

$$x^2 + 6 = 5x$$

$$x^2 - 5x + 6 = 0$$

$$(x-3)(x-2) = 0$$

$$x = 3, 2$$

$$3. \frac{x+1}{3} - \frac{x-1}{2} = 1 \quad \cdot 6$$

$$2(x+1) - 3(x-1) = 6$$

$$2x + 2 - 3x + 3 = 6$$

$$-x - 1 = 0$$

$$x = -1$$

$$4. \frac{x-5}{x+1} = \frac{3}{5}$$

$$5x - 25 = 3x + 3$$

$$2x = 28$$

$$x = 14$$

$$5. \frac{60}{x} - \frac{60}{x-5} = \frac{2}{x} \quad \cdot x(x-5)$$

$$60(x-5) - 60x = 2(x-5)$$

$$60x - 300 - 60x = 2x - 10$$

$$2x = -290$$

$$x = -145$$

$$6. \frac{2}{x+5} + \frac{1}{x-5} = \frac{16}{x^2-25} \quad \cdot (x-5)(x+5)$$

$$2(x-5) + (x+5) = 16$$

$$2x - 10 + x + 5 = 16$$

$$3x = 21$$

$$x = 7$$

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

$$x(x+2) - 2x = 5(x-2)$$

$$x^2 + 2x - 2x = 5x - 10$$

$$x^2 - 5x + 10 = 0$$

$$5 \pm \sqrt{25 - 4(1)(10)}$$

$$2(1)$$

$$\frac{5 \pm \sqrt{-15}}{2}$$

$$2$$

$$\frac{5 \pm i\sqrt{15}}{2}$$

$$2$$

$$8. \frac{x}{2x-6} - \frac{3}{x^2-6x+9} = \frac{x-2}{3x-9} \quad \cdot 6(x-3)^2$$

$$3x(x-3) - 18 = 2(x-3)(x-2)$$

$$3x^2 - 9x - 18 = 2x^2 - 10x + 12$$

$$x^2 + x - 30 = 0$$

$$(x+6)(x-5) = 0$$

$$x = -6, 5$$

$$9. \frac{2x+3}{x-1} = \frac{10}{x^2-1} + \frac{2x-3}{x+1} \quad \cdot (x+1)(x-1)$$

$$(2x+3)(x+1) = 10 + (2x-3)(x-1)$$

$$2x^2 + 5x + 3 = 10 + 2x^2 - 5x + 3$$

$$10x = 10$$

$$x = 1$$

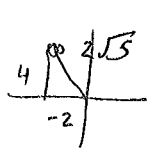
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Topic 14: Solving Rational (fractional) equations

Solve the following problems.

If point P is on the terminal side of θ , find all 6 trig functions of θ . Draw a picture.

1. $P(-2, 4)$

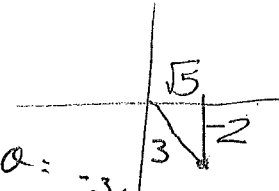


$$\sin \theta = \frac{4}{2\sqrt{5}} \quad \csc \theta = \frac{2\sqrt{5}}{4}$$

$$\cos \theta = \frac{-2}{2\sqrt{5}} \quad \sec \theta = \frac{2\sqrt{5}}{-2}$$

$$\tan \theta = -2 \quad \cot \theta = -\frac{1}{2}$$

2. $P(\sqrt{5}, -2)$

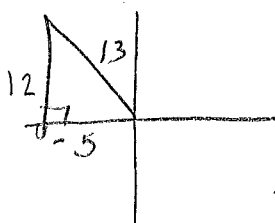


$$\sin \theta = -\frac{2}{3} \quad \csc \theta = -\frac{3}{2}$$

$$\cos \theta = \frac{\sqrt{5}}{3} \quad \sec \theta = \frac{3}{\sqrt{5}}$$

$$\tan \theta = -\frac{2}{\sqrt{5}} \quad \cot \theta = \frac{\sqrt{5}}{-2}$$

3. If $\cos \theta = \frac{5}{13}$, θ in quadrant II,
find $\sin \theta$ and $\tan \theta$



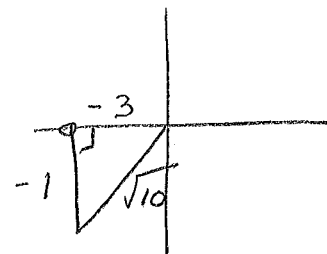
$$\sin \theta = \frac{12}{13}$$

$$\tan \theta = \frac{12}{-5}$$

4. If $\cot \theta = 3$, θ in quadrant III,
find $\sin \theta$ and $\cos \theta$

$$\sin \theta = -\frac{1}{\sqrt{10}}$$

$$\cos \theta = -\frac{3}{\sqrt{10}}$$



Find the exact value of the following without calculators:

5. $\sin^2 225^\circ - \cos^2 300^\circ$

$$\frac{1}{2} - \frac{1}{4}$$

$$\frac{1}{4}$$

6. $(6 \sec 180^\circ - 4 \cot 90^\circ)^2$

$$[6(-1) - 4(0)]^2$$

$$36$$

7. $(4 \cos 30^\circ - 6 \sin 120^\circ)^{-2}$

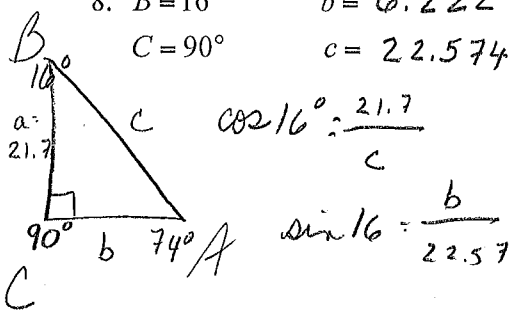
$$\frac{1}{(4(\frac{\sqrt{3}}{2}) - 6(\frac{\sqrt{3}}{2}))^2} = \frac{1}{(2\sqrt{3} - 3\sqrt{2})^2}$$

Solve the following triangles (3 decimal place accuracy)

8. $A = 74^\circ$ $a = 21.7$

$B = 16^\circ$ $b = 6.222$

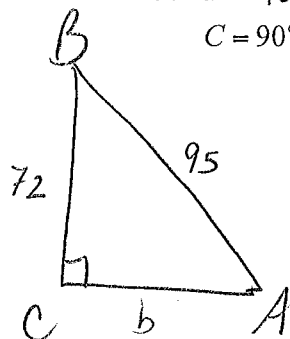
$C = 90^\circ$ $c = 22.574$



9. $A = 49.279$ $a = 6 \text{ feet } 72 \text{ in}$

$B = 40.721$ $b = 61.976$

$C = 90^\circ$ $c = 95 \text{ inches}$



$$\sin 40.721 = \frac{b}{95}$$

$$\sin A = \frac{72}{95}$$

$$A = 49.279$$

Topic 15: Solving Trigonometric equations

Solve each equation on the interval $[0, 2\pi)$

1. $\sin x = \frac{1}{2}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

2. $\cos^2 x = \cos x$

$\cos x (\cos x - 1) = 0$
 $\cos x = 0 \quad \cos x = 1$
 $x = \frac{\pi}{2}, \frac{3\pi}{2}, x = 0$

3. $2\cos x + \sqrt{3} = 0$

$\cos x = -\frac{\sqrt{3}}{2}$
 $x = \frac{5\pi}{6}, \frac{7\pi}{6}$

4. $4\sin^2 x = 1$

$\sin^2 x = \frac{1}{4}$
 $\sin x = \pm \frac{1}{2}$
 $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

5. $2\sin^2 x + \sin x = 1$

$2\sin^2 x + \sin x - 1 = 0$
 $(2\sin x - 1)(\sin x + 1) = 0$
 $\sin x = \frac{1}{2}, \sin x = -1$
 $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$

6. $\cos^2 x + 2\cos x = 3$

$\cos^2 x + 2\cos x - 3 = 0$
 $(\cos x + 3)(\cos x - 1) = 0$
 ~~$\cos x = 3$~~ $\cos x = 1$
 $x = 0$

7. $2\sin x \cos x + \sin x = 0$

$\sin x (2\cos x + 1) = 0$
 $\sin x = 0 \quad \cos x = -\frac{1}{2}$
 $x = 0, \pi, x = \frac{2\pi}{3}, \frac{4\pi}{3}$

8. $8\cos^2 x - 2\cos x = 1$

$8\cos^2 x - 2\cos x - 1 = 0$
 $(4\cos x + 1)(2\cos x - 1) = 0$
 $\cos x = -\frac{1}{4}, \cos x = \frac{1}{2}$
 $104.48^\circ \quad x = \frac{\pi}{3}, \frac{5\pi}{3}$
 255.52°

9. $\sin^2 x - \cos^2 x = 0$

$(\sin x + \cos x)(\sin x - \cos x) = 0$
 $x = \frac{3\pi}{4}, \frac{7\pi}{4}, x = \frac{\pi}{4}, \frac{5\pi}{4}$