In Case You Forgot. . . Review and Formula Sheet

Transformations

If $f(x)$ is the parent function, then it moves in the following ways:

Notation	Transformation
$f(x \pm h)$	$x + h$: moves function to the left h units. $x - h$: moves functions to the right h units.
$f(x) \pm g$	$f(x) + g$: moves function up g units. $f(x) - g$: moves function down g units
$-f(x)$	Reflects function vertically over x-axis.
$f(-x)$	Reflects functions horizontally over y-axis.
$af(x)$	Stretches function vertically by a factor of a.
$f(bx)$	Shrinks function horizontally by a factor of b.

3 forms of a linear function:

1. Standard $Ax + By = C$
2. Slope-intercept $y = mx + b$ $\begin{cases} m = slope \\ b = y - intercept \end{cases}$
3. Point-slope $y - y_1 = m(x - x_1)$ $\begin{cases} m = slope \\ (x_1, y_1) = point\ on\ line \end{cases}$

Slope formula: $\boldsymbol{m = \frac{y_2 - y_1}{x_2 - x_1}}$

If lines are:

Parallel They have the same slope. $m_1 = m_2$

Perpendicular The slopes are negative reciprocals: $m_1 = -\frac{1}{m_2}$

Absolute Value Rules

If $|x| = a$, then $x = \pm a$.

If $|x| < a$, then $-a < x < a$.

If $|x| > a$, then $x < -a$ or $x > a$.

If $x^2 = a$, then $x = \pm\sqrt{a}$.

If $x^2 = a$ for $a < 0$, then $x = \pm i\sqrt{a}$

Quadratic Formula

If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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Quadratic Form	Vertex
$f(x) = ax^2 + bx + c$	$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$
$f(x) = (x-h)^2 + k$	(h, k)

Special Factoring Formulas:

$a^2 \pm 2ab + b^2 = (a \pm b)^2$

$a^2 - b^2 = (a-b)(a+b)$

$a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$

Rational Functions:

Vertical Asymptotes and Holes:

The function is undefined when the denominator equals 0. If

1. A factor in the denominator equals 0, then there is a vertical asymptote at that x-value.
2. You can cancel a factor from the numerator and denominator then there is a hole at that x-value.

Horizontal Asymptotes:

There are three cases. If the degree of

numerator > denominator, then no horizontal asymptote.

numerator < denominator, then horizontal asymptote at $y = 0$.

numerator = denominator, then horizontal asymptote at

$$y = \frac{leading\ coefficient\ of\ numerator}{leading\ coefficient\ \ of\ denomiator}$$

Exponents and Logarithms

Exponential Rules	Logarithmic Rules
$n^a \cdot n^b = n^{a+b}$	$\log_n ab = \log_n a + \log_n b$
$\frac{n^a}{n^b} = n^{a-b}$	$\log_n \frac{a}{b} = \log_n a - \log_n b$
$(n^a)^b = n^{ab}$	$\log_n a^b = b \log_n a$
$n^0 = 1, \qquad n \neq 0$	$\log_n 1 = 0$

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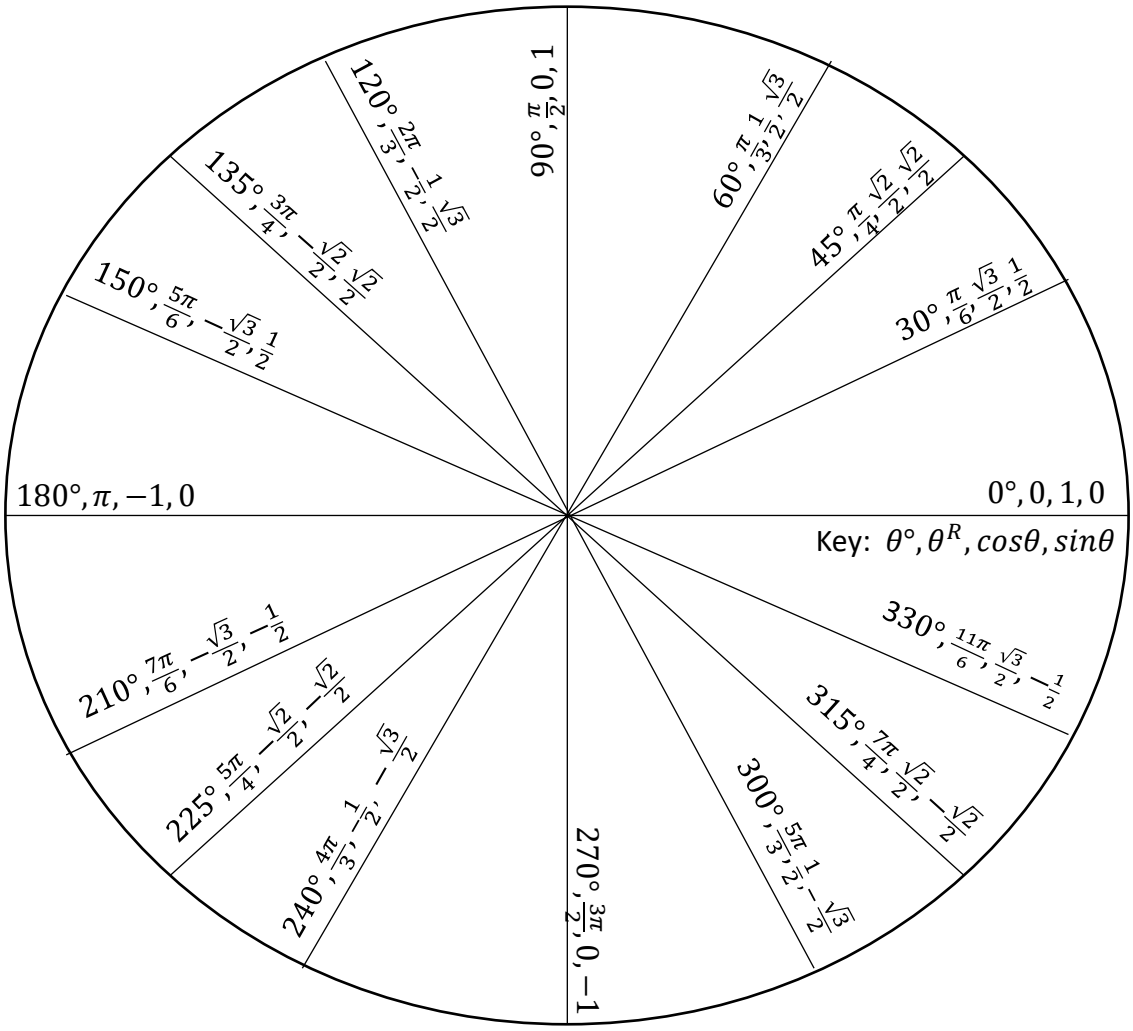
Unit Circle



Trigonometric Identities:

$sin^2x + cos^2x = 1$ $\quad$ $tan^2x + 1 = sec^2x$ $\quad$ $1 + con^2x = csc^2x$

$\frac{sinx}{cosx} = tanx$ $\quad$ $\frac{1}{sinx} = cscx$ $\quad$ $\frac{1}{cosx} = secx$ $\quad$ $\frac{1}{tanx} = cotx$

Geometric Formulas

Circumference of a circle: $C = 2\pi r$

Area of a circle: $A = \pi r^2$

Area of triangle: $A = \frac{1}{2}bh$

Area of equilateral triangle: $A = \frac{\sqrt{3}}{4}s^2$

Distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

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Analytic Geometry:

Circle	$(x-h)^2+(y-k)^2=r^2$	r = radius, (h,k) = center of circle		
Ellipse Equation	Major Axis $a>b>0$	Vertices	Covertices	Foci $c^2=a^2-b^2$
$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	Horizontal	$(\pm a,0)$	$(0,\pm b)$	$(\pm c,0)$
$\frac{x^2}{b^2}+\frac{y^2}{a^2}=1$	Vertical	$(0,\pm a)$	$(\pm b,0)$	$(0,\pm c)$
Hyperbola Equation	Transverse Axis	Vertices	Asymptotes	Foci $c^2=a^2+b^2$
$\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$	Horizontal	$(\pm a,0)$	$y=\pm\frac{b}{a}x$	$(\pm c,0)$
$\frac{y^2}{a^2}-\frac{x^2}{b^2}=1$	Vertical	$(0,\pm a)$	$y=\pm\frac{a}{b}x$	$(0,\pm c)$
Parabola	Focus	Directrix	Axis of Symmetry	
$x^2=4py$	$(0,p)$	$y=-p$	$x=0$	
$y^2=4py$	$(p,0)$	$x=-p$	$y=0$	

Sequences and Series

Arithmetic	Geometric
Sequence $a_n=a_1+(n-1)d$	*Sequence* $a_n=a_1r^{n-1}$
Series $S_n=\sum_{i=1}^{n}a_i=n\left(\frac{a_1+a_n}{2}\right)$	*Finite Series* $S_n=\sum_{i=1}^{n}a_i\,r^{n-1}=a_1\left(\frac{1-r^n}{1-r}\right)$
	Infinite Series $S=\sum_{i=1}^{\infty}a_i\,r^{n-1}=\frac{a_1}{1-r}\quad\lvert r\rvert<1$

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Are You Ready for Calculus? Page 1

Prerequisite Skills

Part I. Review. Fill in the formulas/information below to serve as your study guide.

Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Slope Formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Equations of lines:

Vertical Line: $x = \#$

Horizontal Line: $y = \#$

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Standard Form: $Ax + By = C$

Parallel and Perpendicular Lines:

Parallel lines have the same slope.
Perpendicular lines have slopes that are negative reciprocals of each other
their slopes' product $= -1$

Trigonometric Ratios:

- $\sin\theta = \dfrac{opp}{hyp}$
- $\cos\theta = \dfrac{adj}{hyp}$
- $\tan\theta = opp/adj$
- $\csc\theta = hyp/opp$
- $\sec\theta = hyp/adj$
- $\cot\theta = adj/hyp$

Trigonometric Pythagorean Identities

1. $\sin^2\theta + \cos^2\theta = 1$ 2. $1 + \tan^2\theta = \sec^2\theta$ 3. $1 + \cot^2\theta = \csc^2\theta$

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Are You Ready for Calculus? Page 2

Prerequisite Skills

Part I. Review. Fill in the formulas/information below to serve as your study guide.

Properties of Logarithms:

1. Product: $\log_a(xy) = \log_a x + \log_a y$
2. Quotient: $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$
3. Power: $\log_a x^p = p\log_a x$

Graph $y = \ln x$ and $y = e^x$

$y = \ln x$

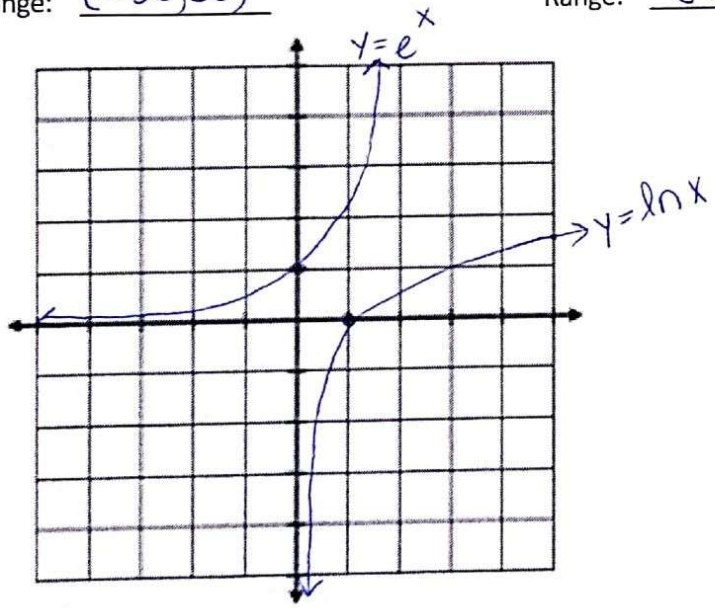
Domain: $(0, \infty)$ or $x > 0$

Range: $(-\infty, \infty)$

$y = e^x$

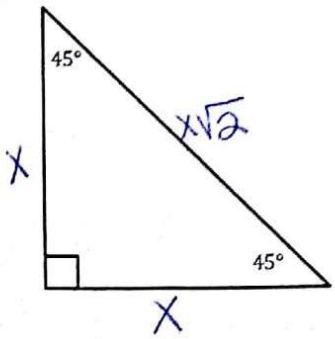
Domain: $(-\infty, \infty)$

Range: $(0, \infty)$ or $y > 0$

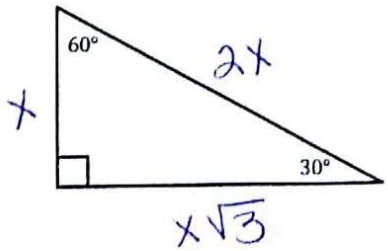


Label 3 Special Right Triangles:

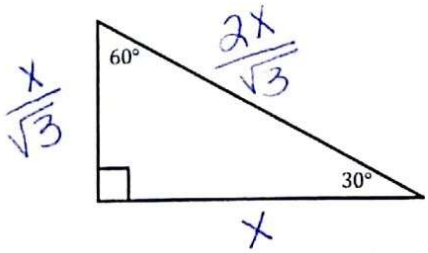
$45° - 45° - 90°$



$30° - 60° - 90°$ (make short leg x)



$30° - 60° - 90°$ (make long leg x)



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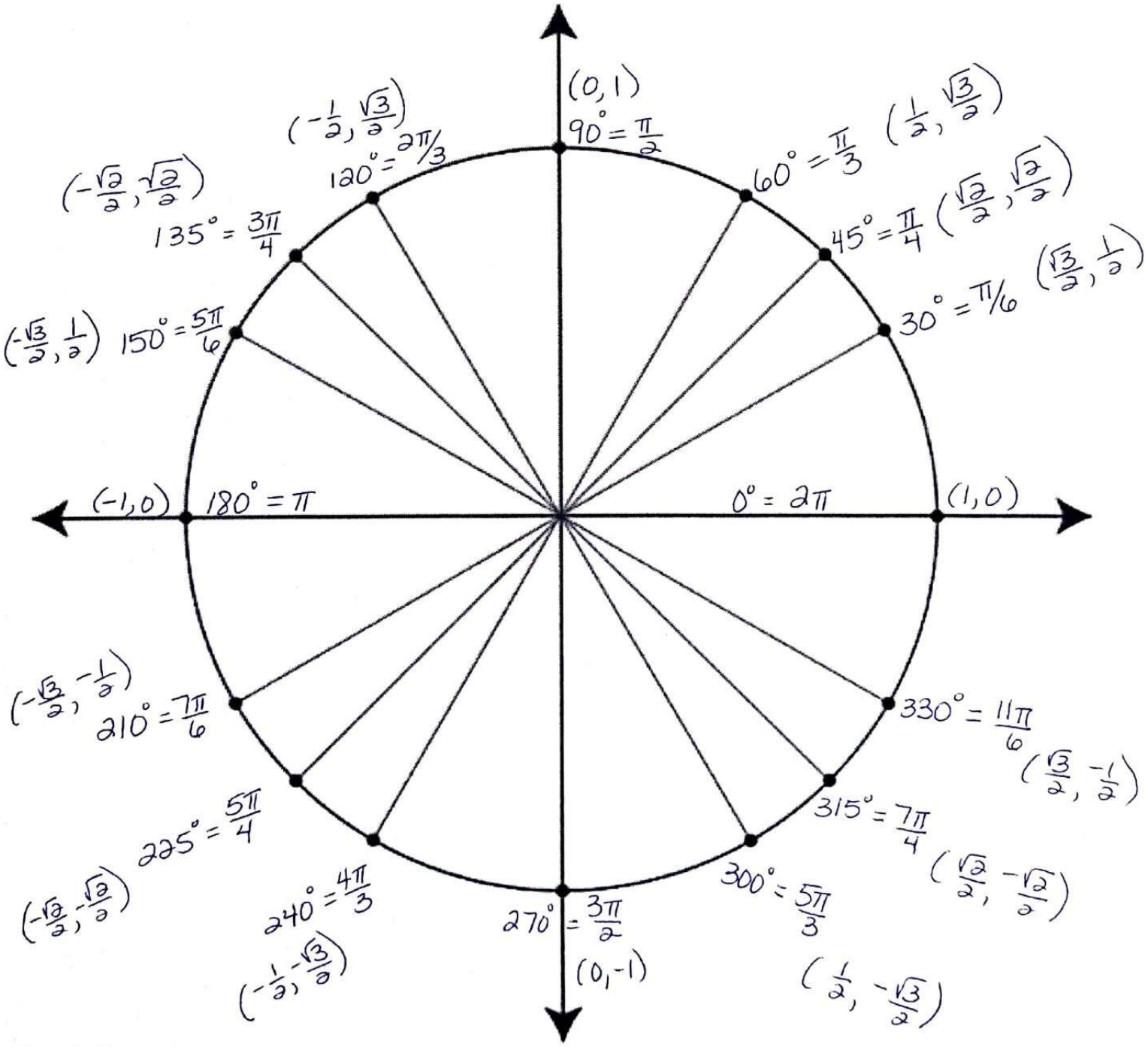
Are You Ready for Calculus? Page 9

Prerequisite Skills

Part VII. Unit Circle

Directions: Label radians, degrees, and points for EVERY angle on the unit circle below.



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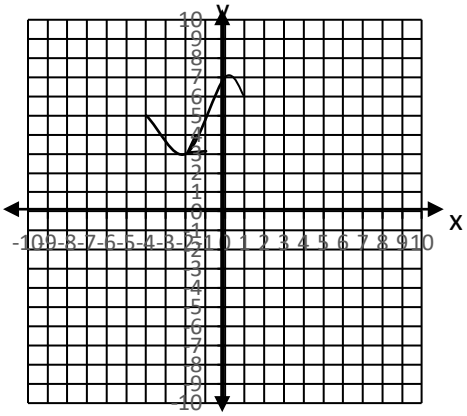
Answer Key

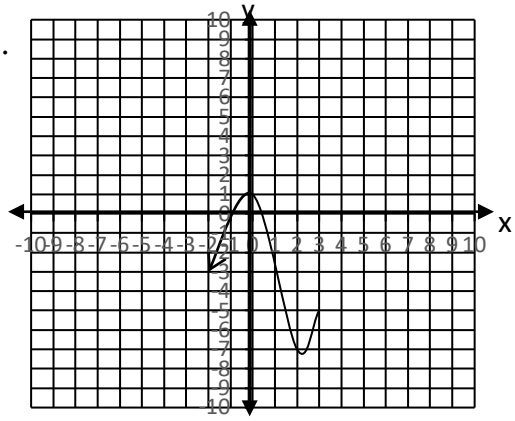
Review of Functions

1. a; 2. b, d, e, f, h

3. a.



b.

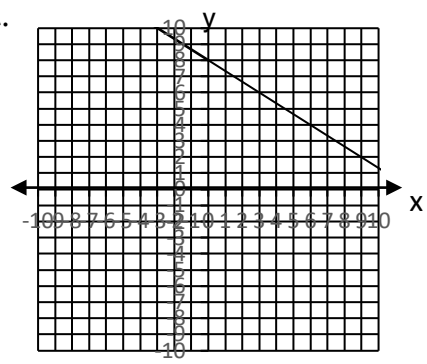


Linear Functions

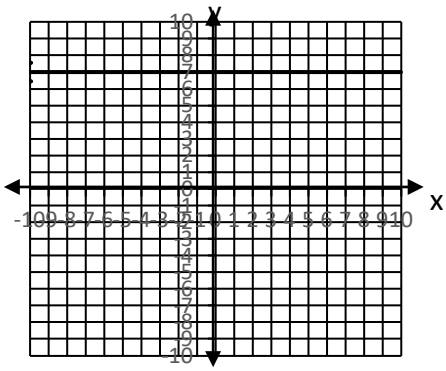
1. $x + 3y = 3$ 2. $\mathrm{f(x)} = -\frac{7}{2}\mathrm{x} + 25$

3. a. Neither b. Parallel c. Perpendicular d. Parallel

4. a.



b.

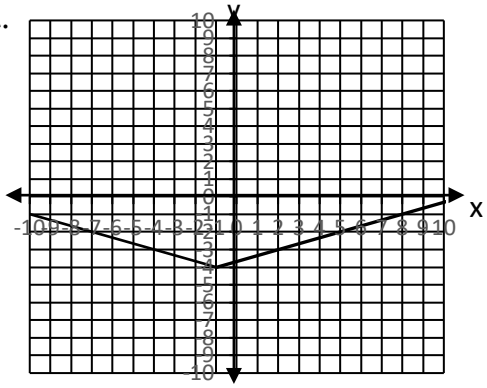


5. $\mathrm{d}(t) = 12t + 7$ She went a total of 15 kilometers.

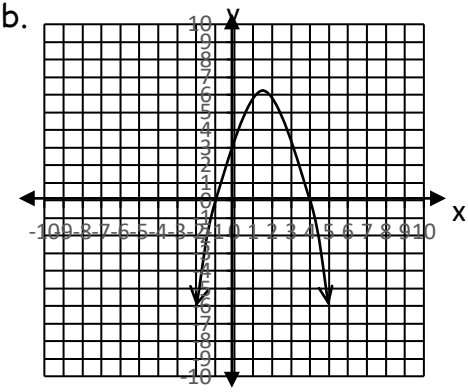
Absolute Value and Quadratics

1. a. $x = \pm 3$; b. $x = -10, 12$; 2. $\{x| -7 < x < 7\}$; 3. $\left(-\infty, \frac{-23}{3}\right] \cup [5, \infty)$

4. a.



b.



5. $x = 1, -\frac{7}{3}$; 6. $x = -\frac{1}{2} \pm \frac{3}{2}i$ 7. In $\frac{\sqrt{7}}{2} \approx 1.323$ sec.

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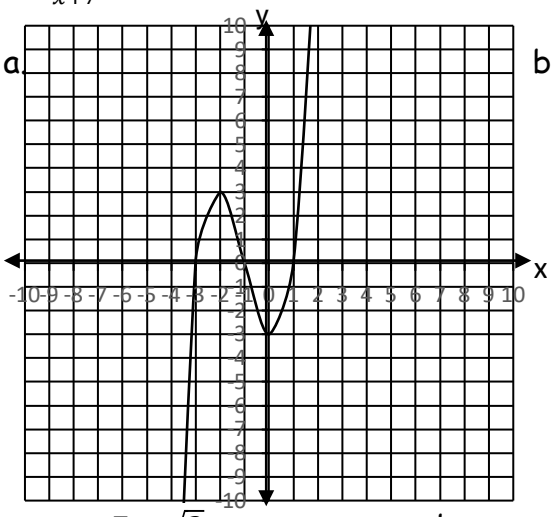
Polynomials and Rational Functions

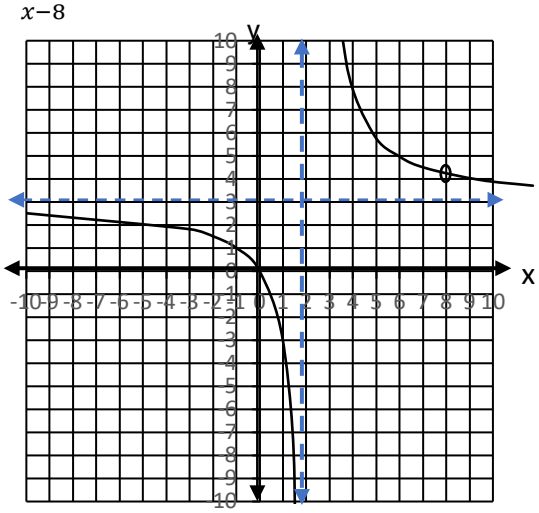
1. a. $(x-3)(x^2+3x+9)$ b. $x(x-5)(x+2)(x-2)$

2. a. $\frac{1}{x+7}$ b. $\frac{2(x+1)}{x-8}$

3. a.



b.

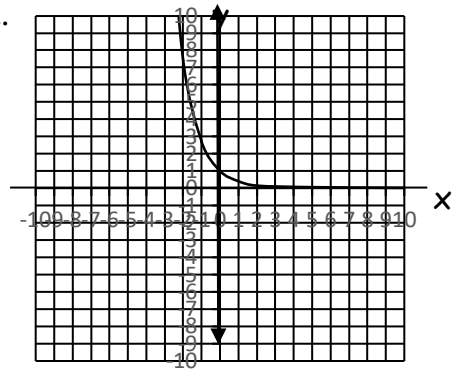


4. a. $x=-7, \pm\sqrt{3}$ b. $x=-4, 3$ c. $x=-2, 5$

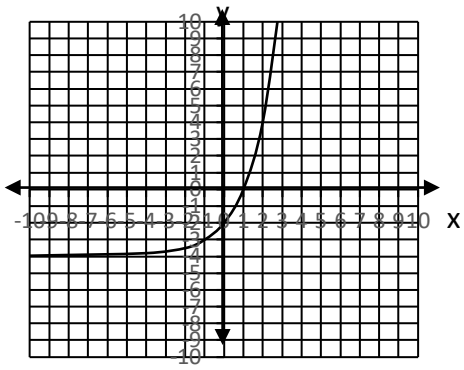
Exponentials

1. a. x^8 b. x^{15} c. $\frac{27x^3y^{27}}{8}$ d. $\frac{y^3}{7}$

2. a.



b.



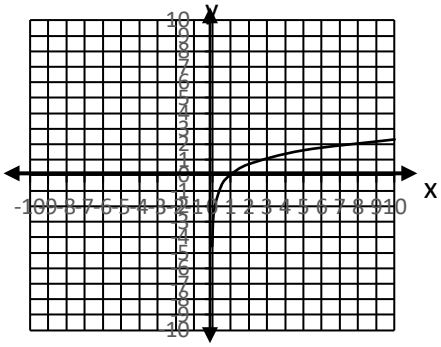
3. a. $x=2$ b. $x=1/3$ c. $x=5/6$ d. $x=-5/2$

4. You will have $563.75 in your account.

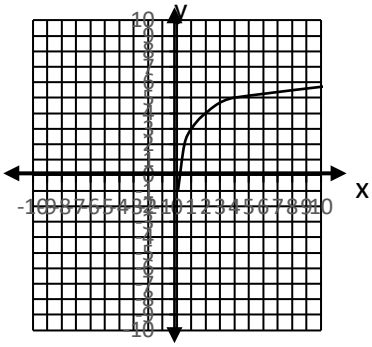
Logarithms

1. a. 1 b. 2 c. 0 d. 1/3 e. $-1/2$ f. 5

2. a.



b.



3. a. $x=1000$ b. $x=63$ c. $x=1/3$ d. $x=\sqrt{5}$

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KEY

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Solve these equations.

1. $2x + 6 = -10$	$x = -8$
2. $x^2 + 5x - 6 = 0$	$x = -6$ $x = 1$
3. $2x^2 + 5x - 12 = 0$	$x = -4$ $x = \frac{3}{2}$
4. $4x^2 + 20x + 25 = 0$	$x = -\frac{5}{2}$
5. $2x^3 - 7x^2 + 9 = 0$	$x = -1$ $x = \frac{3}{2}$ $x = 3$

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Solve these equations.

1. $x^4 + x^3 - 3x^2 - x + 2 = 0$	$x = -2$ $x = -1$ $x = 1$
2. $\sqrt{x-1} = x - 7$	$x = 10$
3. $3^{2x} = 27^4$	$x = 6$
4. $\ln x = 2$	$x = e^2$
5. $e^{x} = 7$	$x = \ln 7$

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Factor completely.

1. $x^3 + 27$ $(x+3)(x^2-3x+9)$	
2. $(x+2)^3(x-3)^5+(x-3)^6(x+2)^2$ $(x+2)^2(x-3)^5(2x-1)$	
3. $3(x-2)^{\frac{3}{2}}(x+1)^2+6(x-2)^{\frac{5}{2}}(x+1)^3$ $3(x-2)^{3/2}(x+1)^2(2x^2-2x-3)$	
4. $x^3 - 64$ $(x-4)(x^2+4x+16)$	
15. $5x^2(x+4)^5(x+3)^2-10x^3(x+4)^4(x+3)^3$ $5x^2(x+4)^4(x+3)^2(-2x^2-5x+4)$	

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http://www.coolmath.com/precalculus-review-calculus-intro/precalculus-algebra/26-factoring-for-product-rule-01

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Write the equation of the line.

1. Write the equation of the line that goes through the point (-2, 3) with a slope of ½.	$y = \frac{1}{2}x + 4$
2. Write the equation of the line parallel to y = 3x – 7 that goes through the point (0, -4).	$y = 3x - 4$
3. Write the equation of the line that is perpendicular to $y = \frac{3}{2}x + 4$ and goes through the point (3, -2).	$y = \frac{-2}{3}x$
4. Write the equation of the line that goes through the points (5, -1) and (4, 6).	$y = -7x + 34$
5. If a line is drawn so that it forms a 30° angle with the x-axis, what is its slope?	$\frac{\sqrt{3}}{3} = .577$

Need Help? Look at this website:
http://www.coolmath.com/precalculus-review-calculus-intro/precalculus-algebra/02-graphing-equations-of-lines-01

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Are You Ready for Calculus? Page 6

Prerequisite Skills

Part IV. Composite and Inverse Functions

Directions: Read each question. Show all work where needed.

1. If $f(x) = 5 - x^2$ *and* $g(x) = \sqrt{x+3}$,

a) Write a formula for $f \circ g$ and $g \circ f$

$f \circ g = f(g(x)) = 5 - (\sqrt{x+3})^2 = 5 - (x+3) = 2 - x$

$g \circ f = g(f(x)) = \sqrt{(5-x^2)+3} = \sqrt{8-x^2}$

b) find the domain and range of each.

Domain: $[-3, \infty)$

Range: $(-\infty, 5]$

$f \circ g$

Domain: $[-\sqrt{8}, \sqrt{8}]$

$8 - x^2 \geq 0$

$-x^2 \geq -8$

$x^2 \leq 8$

$-\sqrt{8} \quad \sqrt{8}$

Range: $[0, \sqrt{8}]$

$g \circ f$

2. If $f(x) = 3 - 4x$,

a) Find f^{-1}

$y = 3 - 4x$

$x = 3 - 4y$

$x - 3 = -4y$

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

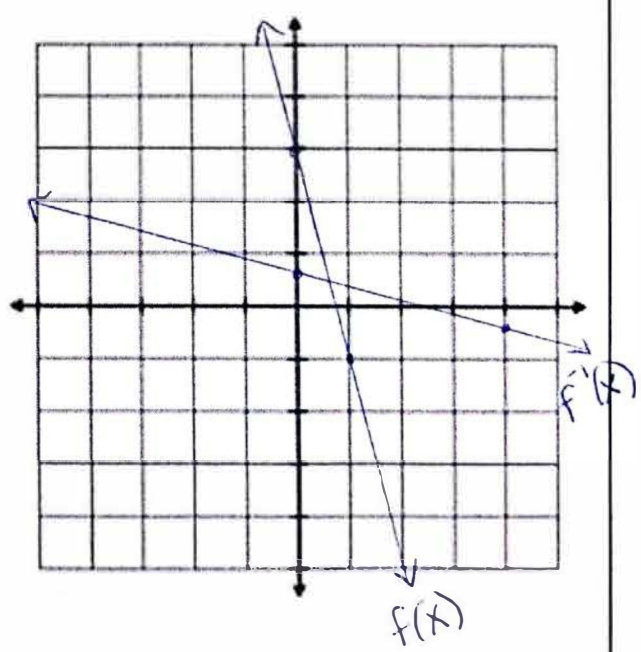
$f^{-1}(x) = -\frac{1}{4}x + \frac{3}{4} = \frac{3-x}{4}$

b) b) Show that $(f \circ f^{-1})(x) = (f^{-1} \circ f)(x) = x$

$(f \circ f^{-1})(x) = 3 - 4\left(-\frac{1}{4}x + \frac{3}{4}\right) = 3 + x - 3$
$= x$

$(f^{-1} \circ f)(x) = -\frac{1}{4}(3 - 4x) + \frac{3}{4}$

$= -\frac{3}{4} + x + \frac{3}{4} = x$



c) Graph f and f^{-1} on the same coordinate plane.

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Miscellaneous. Follow the directions in each box.

1. Evaluate without a calculator. A) $9^{\frac{3}{2}}$ B) $32^{\frac{2}{5}}$	A) 27 B) 4
2. If f(x) = 2x -3 and g(x) = x^2, find: A) f(g(2)) B) g(f(-1))	A) 5 B) 25
3. Using that f(x) = 3x – 5, find: $\frac{f(x+h)-f(x)}{h}$	3
4. Solve the system of equations. $2x+3y=12$ $-x+2y=10$	$x = -\frac{6}{7}$ $y = \frac{32}{7}$
5. If y varies directly as x when x= 2 then y = 5. What is the value of y when x = 7?	$x = \frac{14}{5}$

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Simplify.

1. $\frac{1}{x+2}+\frac{3}{x-3}$	$\frac{4x+3}{(x-3)(x+2)}$
2. $2\ln(x+5)-\ln(x+2)$	$\ln\left(\frac{(x+5)^2}{(x+2)}\right)$
3. $\frac{x^2+7x+12}{x-3}\div\frac{x^2-16}{x^2-9}$	$\frac{(x+3)^2}{(x-4)}$
4. $\frac{\frac{1}{x+2}}{\frac{3}{x^2-4}}$	$\frac{x-2}{3}$
5. Word Problem Fun. You are driving across a flat area. In the distance directly in front of you, you notice a mountain. The angle of elevation to the peak is 4°. After you drive 13 miles closer to the mountain, the angle of elevation is 10°. How tall is the mountain?	1.51 miles

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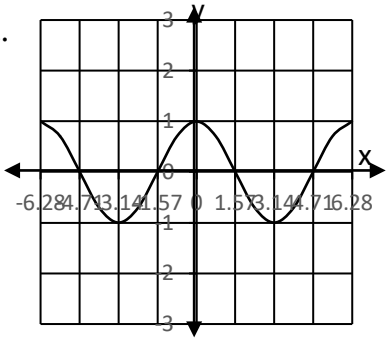
The Unit Circle

1. 1	2. $\sqrt{3}/2$	3. $-\sqrt{2}/2$	4. -1	5. $-\sqrt{2}/2$	6. $\sqrt{3}/2$
7. 1	8. $-\sqrt{3}/3$	9. 0	10. ½	11. 0	12. -1
13. -1	14. $-\sqrt{3}/2$	15. 0	16. ½	17. $-\sqrt{3}/2$	18. $-\sqrt{3}$
19. 1	20. $undef.$	21. $\sqrt{3}$	22. $\sqrt{2}/2$	23. $\sqrt{3}/3$	24. $\sqrt{2}/2$

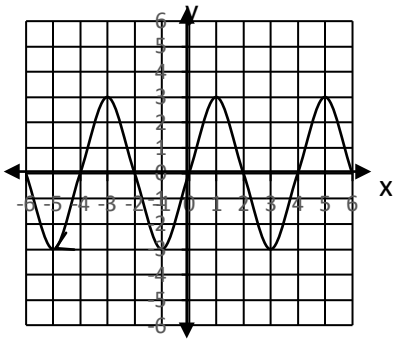
Trigonometric Functions

1. 1

2. a.



b.

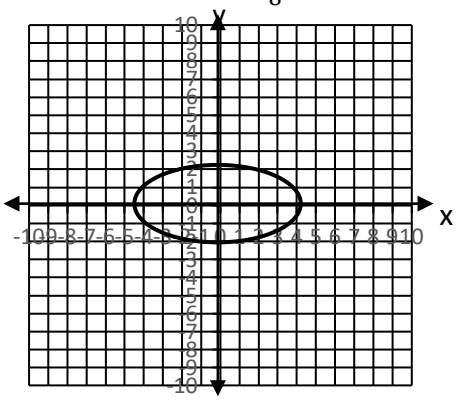


3. a. $\cos x$ b. $tan^2 x$ c. $\tan x$ d. $\cos x$

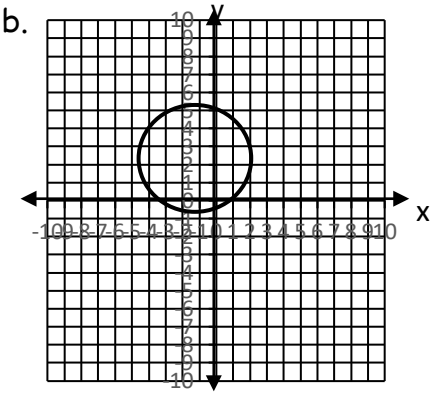
Geometry Formulas and Analytic Geometry

1. $A = (x-3)^2$ 2. $\frac{\pi x}{8}$ 3. $\frac{\sqrt{3}}{4}(sinx - 1)^2$

4. a.



b.



5. $(x+13)^2 + (y-22)^2 = 49$

Sequences and Series

1. a. N	b. *G*	c. *A*	d. *G*
2. a. 30	b. 60	c. 62	d. 3/2

3. a. $\frac{3(4^2)(5^2)}{4} = 300$ b. $\frac{8(9)(17)}{6} - \frac{2(8)(9)}{2} + 7(8) = 188$

4. $\infty. (An\ infinite\ amount\ of\ fun, of\ course!)$

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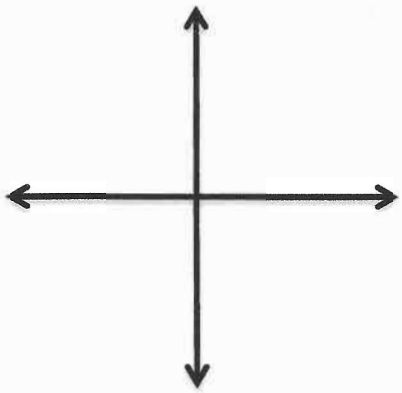
The Summer Before Calculus AB Study Guide

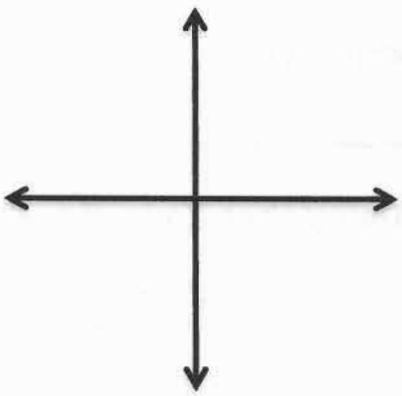
Remember the natural log and exponential functions?

1. Evaluate: A) ln 1 = B) ln e = C) e^0 = D) What is the approximate value of e?	A) 0 B) 1 C) 1 D) 2.71828

2. Draw the natural log function. Label the points where the function intersects the x or y axis.



3. Draw the exponential function. Label the points where the function intersects the x or y axis.



4. A) What is the domain of the natural log function? B) What is the domain of the exponential function?	A) $(0, \infty)$ B) $(-\infty, \infty)$
5. A) What is the range of the natural log function? B) What is the range of the exponential function?	A) $(-\infty, \infty)$ B) $(0, \infty)$

Do you wonder what you might use calculus for? Watch this Ted Talk:
https://youtu.be/_Idra8rVS1I

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Answers:

1. C		
2. B		
3. A		
4. B		
5. D		
6. C		
7. D		
8. A		
True/False		
9. F	16. F	
10. F	17. F	
11. T	18. F	
12. T	19. T	
13. F	20. F	
14. F	21. F	
15. T	22. F	
23.	Student answers will vary	
24.	A) $1 + 10\sqrt{2}$	B) $-2\sqrt{5}$
	C) $-\frac{\sqrt{2}}{4}$	D) 20
25.	$k = -7$	$m = \frac{1}{2}$
26A.	0	∞
26B.	DNE	$-1, 1$
26C.	6	6
26D.	1	DNE
26E.	DNE	$0, 0$
26F.	-5, DNE	$1, 1$
26G.	$\frac{1}{2}$, DNE, $\frac{1}{4}$	$0, 0$
26H.	4,2	$\infty, -\infty$

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