

SAMPLE PREREQUISITE PROBLEMS: PRECALCULUS

(no calculators allowed)

Multiplication Tables (through 12)

(You will have two minutes to do the following 24 multiplication problems.)

$2 \times 6 =$

$3 \times 2 =$

$4 \times 9 =$

$5 \times 2 =$

$8 \times 8 =$

$9 \times 3 =$

$10 \times 7 =$

$2 \times 4 =$

$5 \times 1 =$

$6 \times 8 =$

$7 \times 9 =$

$8 \times 10 =$

$0 \times 10 =$

$1 \times 11 =$

$7 \times 3 =$

$11 \times 9 =$

$6 \times 4 =$

$7 \times 11 =$

$3 \times 7 =$

$4 \times 5 =$

$9 \times 5 =$

$10 \times 6 =$

$12 \times 10 =$

$9 \times 12 =$

(Be sure that you can easily do problems like these: arithmetic with whole numbers, decimals, fractions; arithmetic with signed numbers)

$\frac{0}{7.2} =$

$-\frac{(6)(-2)}{-3} =$

$-3 - (-2) =$

$1,000 \times 3.47 =$

$\frac{248.36}{100} =$

$\frac{1}{3} - \frac{1}{5} =$

$\frac{1}{3} \cdot \frac{1}{5} =$

$\frac{1}{3} \div \frac{1}{5} =$

$126 \times 24 =$

SAMPLE PREREQUISITE PROBLEMS: PRECALCULUS

Problems 1–13 should be done WITHOUT A CALCULATOR.

1. For each expression given below, rename the expression as requested. If the requested name is not possible, so state. A few samples are done for you.

EXPRESSION	RENAME IN THIS FORM	ANSWER
(sample) 12	a sum of even integers	2 + 10 or 4 + 8 etc.
(sample) 12	2^x , where $x \in \{0, 1, 2, 3, \dots\}$	not possible
$\frac{1}{\sqrt{2}}$	a fraction with no radical in the denominator	
23,070,000	in scientific notation	
$x^2 - y^2$	as a product (i.e., factor)	
$\frac{x^4 x^{-1}}{(x^2)^3 x}$	x^k	
300 ft/sec	x mph (there are 5,280 feet in one mile)	
1,006	$x \cdot 10^2 + y \cdot 10^{-1}$	
$8^{-2/3}$	as a simple fraction	
$x^2 + 2x + 3$	involving a perfect square, $(x + k)^2$	
$ 2x + 3 $, for $x < -\frac{3}{2}$	without absolute values	
$2 \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$	$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$	
$2 + 3i - i^2 + (1 - i)(3 + 4i)$, ($i = \sqrt{-1}$)	$a + bi$	
$\frac{x^2 - x - 1}{x - 3}$	$Q(x) + \frac{R(x)}{D(x)}$	
$\log_7 5$	involving the natural log	
$\frac{4 \log 10^x}{3}$	without logarithms	
$\ln x^4 - \ln x^2 + \ln(x^2 + 1)$	a single logarithm	
$(x - 2y)^4$	expanded form (Hint: use Pascal's triangle)	
$(-\infty, -2] \cap (-4, 5]$	as a single interval	
$\{x \mid x \geq -2\}$	using interval notation	

2. Solve each equation/inequality/system. Get EXACT answers, not decimal approximations. Report each solution set using correct set notation. A sample is done for you.

(sample) $x^2 - 2x > 3$

Solution: Rewrite:

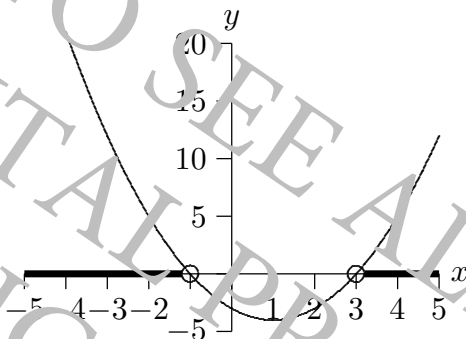
$$x^2 - 2x - 3 > 0$$

$$(x - 3)(x + 1) > 0$$

(graph $y = (x - 3)(x + 1)$; see where graph lies above x -axis and read off solution set)

$$x < -1 \text{ or } x > 3$$

$$\text{Solution set: } (-\infty, -1) \cup (3, \infty)$$



(a) $3x(1 - 5x)(x^2 - 16) = 0$

(b) $\frac{1}{2}x - 7 = 3x - \frac{x}{5}$

(c) $|2x - 3| > 5$

(d) $2 < |x| < 3$

(e) $1 - 2x \leq 3$ or $-3 \leq x < -2$

(f) $x^2 = x + 2$

(g) $2x - 3x^2 \leq -1$

(h) $3^{2x-1} = 10$

(i) $\log_3(x^2 - 1) = -2$

(j) $\sqrt{3x^2 + 5x - 3} = x$

(k) $y = x^2 + 1$ and $y = 2x + 4$

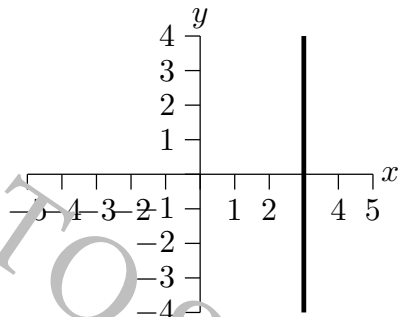
(l) $x + 3 = \frac{-2x^2 + 7x - 3}{x - 3}$

(m) Let $f(x) = \begin{cases} x + 2, & \text{if } x < 0 \\ 2, & \text{if } 0 \leq x < 1 \\ x - 1 & \text{if } x \geq 1 \end{cases}$. Solve the equation $f(x) = 1$.

3. Graph each of the following equations/inequalities, where each sentence is viewed as a sentence in two variables. (That is, $x = 3$ should be viewed as $x + 0y = 3$.) A sample is done for you.

(sample) $x = 3$

Solution:



- (a) $x > 3$
 (b) $2y - 3 = 0$
 (c) $x = 3$ and $y = 2$
 (d) $x = 3$ or $y = 2$
 (e) $y - 2x + 1 = 0$
 (f) $y = -2\sqrt{x+3} + 1$
 (g) $|x| = 2$
 (h) $y \leq 2$
 (i) $\frac{y-2}{3} = 2x - 1$
 (j) $\frac{y-2}{3} \geq 2x - 1$
 (k) $x^2 + 2x + y^2 - 6y - 15 = 0$

4. Write a list of transformations that takes the graph of $y = f(x)$ to the graph of $y = 5 - 3|f(x+1)|$. There may be more than one correct answer.

EQUATION	TRANSFORMATION
$y = f(x)$	(starting place)

5. Starting with the equation $y = x^2 - 2x + 1$, apply the specified sequence of transformations.

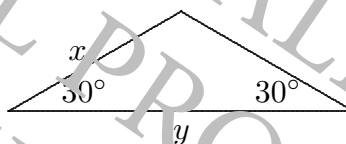
EQUATION	TRANSFORMATION
$y = x^2 - 2x + 1$	(starting place)
	up 1
	left 3
	reflect about the x -axis
	vertical scale by a factor of 2

6. Find the requested measurement(s) of each geometric figure.

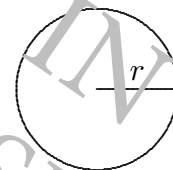
- (a) PERIMETER and AREA:



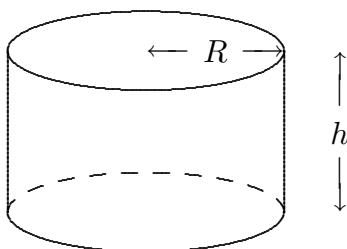
- (b) PERIMETER and AREA:



- (c) CIRCUMFERENCE and AREA:



- (d) VOLUME:



Which of the units below is a unit of length? Of area? Of volume?

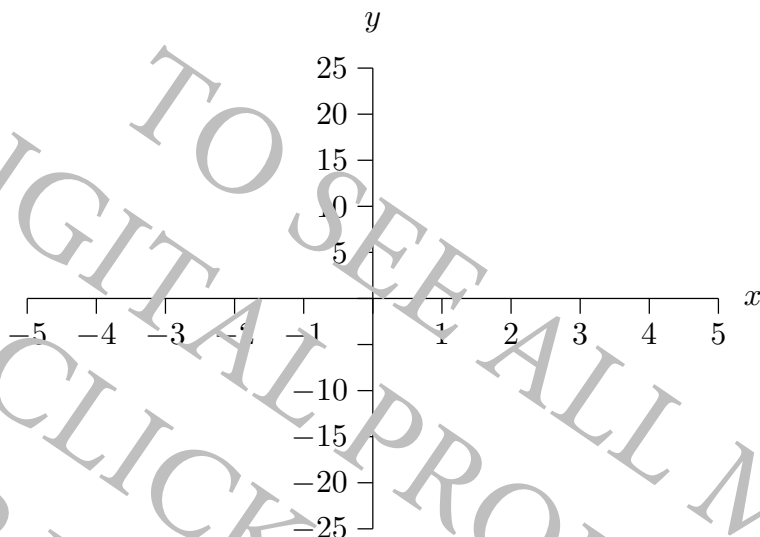
cubic feet

cm^2

meter

7. (a) Let $f(x) = x^2 - 2x + 1$ and $g(x) = 1 - 3x$. Find both $g(f(x))$ and $f(g(x))$.
 (b) Find functions f and g such that $f(g(x)) = \sqrt[3]{x^2 - 1}$.

8. Graph the rational function $g(x) = \frac{(x^2 - 1)(x + 2)}{(2x - 1)(x + 3)(x + 2)}$ in the space below.



If any of the following do not exist, so state:
 x -intercept(s): _____
 y -intercept(s): _____
 Equation(s) of any horizontal asymptote(s): _____
 Equation(s) of any vertical asymptote(s): _____
 Equation(s) of any slant asymptote(s): _____
 Puncture point(s): _____
 Fill in the blank: as $x \rightarrow \infty$, $y \rightarrow$ _____
 Fill in the blank: as $x \rightarrow -3^+$, $y \rightarrow$ _____

9. Find the equation of a polynomial P satisfying the following properties: $P(-3) = 0$, 1 is a zero of P , the graph of P crosses the x -axis at $x = 2$, P has degree 5, and $P(0) = 7$.

10. Write an expression (using the variable x) to represent each sequence of operations.
- take a number, multiply by 2, then subtract 3
 - take a number, subtract 3, then multiply by 2
 - take a number, multiply it by 2, cube the result, add 1, then divide by the original number

Write the sequence of operations that is being described by each expression.

- $3x - 1$
 - $2(x + 1)^3 - 5$
 - $\frac{x - 3}{7} - 1$
11. Let $f(x) = x^2 - 2x + 1$. Evaluate each of the following expressions.
- $f(0)$
 - $f(1) - 2$
 - $f(f(-1))$
12. Find the domain of the function $g(x) = \frac{1}{\sqrt{x-3}}$. Report your answer using interval notation.
13. Write the equation of the line, in $y = mx + b$ form, that satisfies the given conditions.
- slope 3, passing through the point $(2, -1)$
 - the horizontal line that crosses the y -axis at 2
 - the line that is perpendicular to $x - y = 5$ and passes through the point $(0, 3)$
14. (Your calculator is needed for parts of this question.)
- What is the domain of the function $f(x) = \frac{1 - 3x}{x - 2}$?
 - Use your graphing calculator to graph the function f in the window $-1 < x < 3$ and $-15 < y < 10$.
 - Find the x -intercept of the graph.
 - Use your calculator to estimate a value for x for which $f(x) = 5$. (Zoom, as necessary, to get $f(x)$ within 0.01 of 5.)
15. Estimate (where necessary) each of the following numbers on your calculator. For full credit, each answer must be correct to five decimal places.
- $\frac{1 + \sqrt{2}}{\sqrt[3]{5} - 7}$
 - $3x^2 - 5x + 1$, where $x = -1.8$
 - $|1 - 2x|$, where $x = \sqrt{3}$
 - $(2.03 \times 10^{-9})(-4.1 \times 10^7)$

SOLUTIONS

Multiplication Tables:

12, 6, 36, 10

64, 27, 70, 8

5, 48, 63, 80

0, 11, 21, 99

24, 77, 21, 20

45, 60, 120, 108

0, -4, -1

3,470, 2.4836, $\frac{2}{15}$

$\frac{1}{15}$, $\frac{5}{3}$, 3,024

1. There are many possible correct answers for some of these problems, but these are the most obvious ones:

$$\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$23,070,000 = 2.307 \times 10^7$$

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

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

$$300 \frac{\text{ft}}{\text{sec}} = 300 \frac{\text{ft}}{\text{sec}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \approx 204.5 \frac{\text{miles}}{\text{hr}}$$

$$7,036 = 70 \cdot 10^2 + 360 \cdot 10^{-1}$$

$$8^{-2/3} = \frac{1}{8^{2/3}} = \frac{1}{(8^{1/3})^2} = \frac{1}{2^2} = \frac{1}{4}$$

Use the technique of completing the square:

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

When $x < -\frac{3}{2}$, $2x + 3 < 0$. Thus, $|2x + 3| = -(2x + 3) = -2x - 3$.

$$2 \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix} - \begin{bmatrix} 3 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix} = \begin{bmatrix} 2 & -4 \\ -2 & 6 \end{bmatrix} - \begin{bmatrix} 3 & 2 \\ 0 & 4 \end{bmatrix} = \begin{bmatrix} -1 & -6 \\ -2 & 2 \end{bmatrix}$$

$$2 + 3i - i^2 + (1 - i)(3 + 4i) = 2 + 3i - (-1) + 3 + 4i - 3i - 4(-1) = 10 + 4i$$

Use long division of polynomials to get $\frac{x^2-x-1}{x-3} = x + 2 + \frac{5}{x-3}$. Do a “spot-check”: when $x = 0$, we have $\frac{x^2-x-1}{x-3} = \frac{0^2-0-1}{0-3} = \frac{1}{3}$; when $x = 0$, we have $x + 2 + \frac{5}{x-3} = 0 + 2 + \frac{5}{0-3} = \frac{6}{3} - \frac{5}{3} = \frac{1}{3}$. They agree when $x = 0$! (A “spot-check” like this catches lots of mistakes.)

Use the change of base formula for logarithms: $\log_b x = \frac{\log_a x}{\log_a b}$

Thus, $\log_7 5 = \frac{\ln 5}{\ln 7}$. Check that $7^{(\log_7 5)} = 5$.

$$\frac{4 \log 10^x}{3} = \frac{4}{3} x \log 10 = \frac{4}{3} x(1) = \frac{4}{3} x$$

Use properties of logarithms:

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

Use the row of Pascal's triangle beginning with "1 4": Thus, $(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$. Since $(x - 2y)^4 = (x + (-2y))^4$, we apply this formula with $a = x$ and $b = -2y$ to get:

$$\begin{aligned}(x + (-2y))^4 &= x^4 + 4x(-2y)^3 + 6x^2(-2y)^2 + 4x^3(-2y) + (-2y)^4 \\ &= x^4 - 32xy^3 + 24x^2y^2 - 8x^3y + 16y^4\end{aligned}$$

$$(-\infty, -2] \cap (-4, 5] = (-4, -2]$$

$$\{x \mid x \geq -2\} = [-2, \infty)$$

2.

$$(a) \quad 3x(1 - 5x)(x^2 - 16) = 0$$

$$x = 0 \quad \text{or} \quad 1 - 5x = 0 \quad \text{or} \quad x^2 - 16 = 0$$

$$x = 0 \quad \text{or} \quad x = \frac{1}{5} \quad \text{or} \quad x = \pm 4$$

$$\text{Solution set: } \left\{0, \frac{1}{5}, \pm 4\right\}$$

$$(b) \quad \frac{-x}{2} - 7 = 3x + \frac{x}{5}$$

$$-5x - 70 = 30x + 2x \quad (\text{clear fractions; multiply by 10})$$

$$-70 = 27x$$

$$x = \frac{-70}{27}$$

$$\text{Solution set: } \left\{-\frac{70}{27}\right\}$$

$$(c) \quad |2x - 3| > 5$$

$$2x - 3 > 5 \quad \text{or} \quad 2x - 3 < -5$$

$$2x > 8 \quad \text{or} \quad 2x < -2$$

$$x > 4 \quad \text{or} \quad x < -1$$

$$\text{Solution set: } (-\infty, -1) \cup (4, \infty)$$

$$(d) \quad 2 < |x| < 3$$

solve by inspection; want all #s whose distance from 0 is between 2 and 3

$$-3 < x < -2 \quad \text{or} \quad 2 < x < 3$$

$$\text{Solution set: } (-3, -2) \cup (2, 3)$$

$$(e) \quad 1 - 2x \leq 3 \quad \text{or} \quad -3 \leq x < -2$$

$$x \geq -1 \quad \text{or} \quad -3 \leq x < -2$$

$$\text{Solution set: } [-3, -2) \cup (-1, \infty)$$

$$(f) \quad x^2 = x + 2$$

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

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

$$x = 2 \quad \text{or} \quad x = -1$$

$$\text{Solution set: } \{-1, 2\}$$

$$(g) \quad 2x - 3x^2 \leq -1$$

$$-3x^2 + 2x + 1 \leq 0$$

$$3x^2 - 2x - 1 \geq 0$$

$$\text{Note: } 3x^2 - 2x - 1 = 0$$

$$x = \frac{2 \pm \sqrt{4 - 4(3)(-1)}}{6} = \frac{2 \pm \sqrt{16}}{6} = \frac{2 \pm 4}{6} = 1, -\frac{1}{3}$$

Thus, the graph of $y = 3x^2 - 2x - 1$ crosses the x -axis at $-\frac{1}{3}$ and 1 , and holds water.

$$\text{Solution set: } \left(-\infty, -\frac{1}{3}\right] \cup [1, \infty)$$

$$(h) \quad 3^{2x-1} = 10$$

$$\ln 3^{2x-1} = \ln 10$$

$$(2x - 1) \ln 3 = \ln 10$$

$$2x - 1 = \frac{\ln 10}{\ln 3}$$

$$2x = \frac{\ln 10}{\ln 3} + 1$$

$$x = \frac{1}{2} \left(\frac{\ln 10}{\ln 3} + 1 \right)$$

$$\text{Solution set: } \left\{ \frac{1}{2} \left(\frac{\ln 10}{\ln 3} + 1 \right) \right\}$$

$$(i) \quad \log_3(x^2 - 1) = -2$$

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

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

$$x^2 = \frac{10}{9}$$

$$x = \pm\sqrt{\frac{10}{9}}$$

$$\text{Solution set: } \left\{ \sqrt{\frac{10}{9}}, -\sqrt{\frac{10}{9}} \right\}$$

$$(j) \quad \sqrt{3x^2 + 5x - 3} = x$$

square both sides, must check for extraneous solutions at the end

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

Solve using the quadratic formula to get:

$$x = \frac{1}{2} \quad \text{or} \quad x = -3$$

Discard $x = -3$; it is an extraneous solution.

Verify that $x = \frac{1}{2}$ is indeed a solution.

$$\text{Solution set: } \left\{ \frac{1}{2} \right\}$$

$$(k) \quad y = x^2 + 1 \quad \text{and} \quad y = 2x + 4$$

A quick sketch verifies that there are two solutions:

$$x^2 + 1 = 2x + 4$$

$$x = 3 \quad \text{or} \quad x = -1$$

When $x = 3$, $y = 10$; when $x = -1$, $y = 2$.

$$\text{Solution set: } \{(3, 10), (-1, 2)\}$$

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

Clear fractions; potential for an extraneous solution when $x = 3$:

$$(x + 3)(x - 3) = -2x^2 + 7x - 3$$

Solve the quadratic equation, yielding:

$$x = 3 \quad \text{or} \quad x = -\frac{2}{3}$$

Discard $x = 3$; it is an extraneous solution.

$$\text{Solution set: } \left\{-\frac{2}{3}\right\}$$

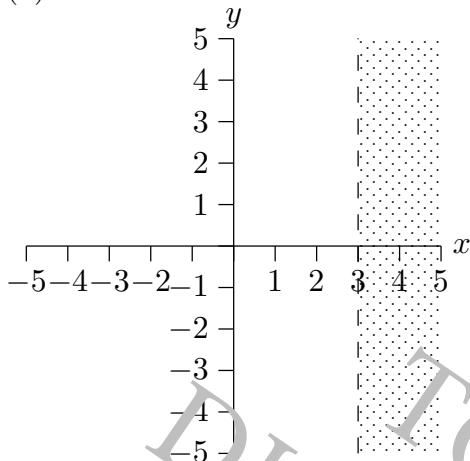
(m) Use a graphical approach to see that there are two solutions:

$$x + 2 = 1 \quad \text{when} \quad x = -1$$

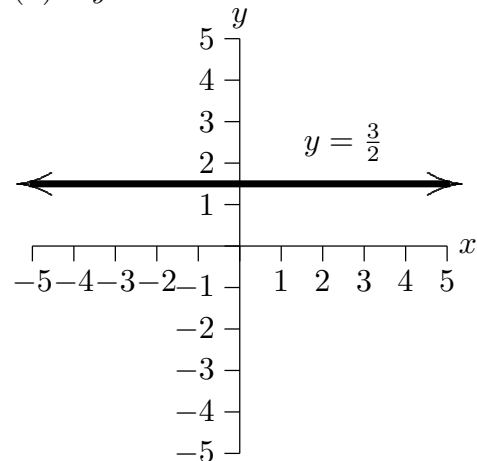
$$x - 1 = 1 \quad \text{when} \quad x = 2$$

$$\text{Solution set: } \{-1, 2\}$$

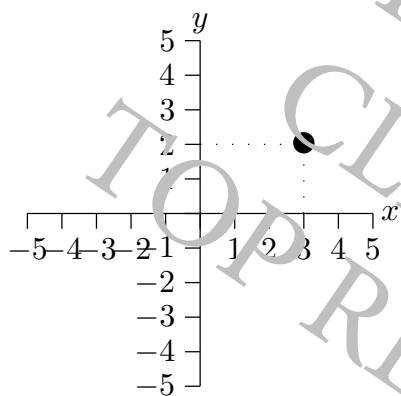
3. (a) $x > 3$



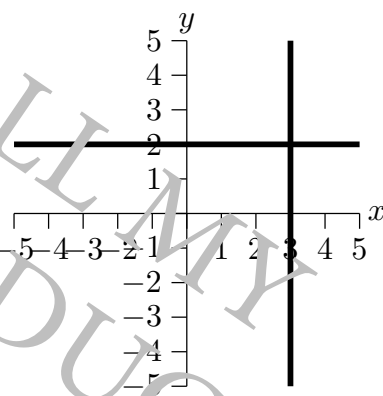
(b) $2y - 3 = 0$



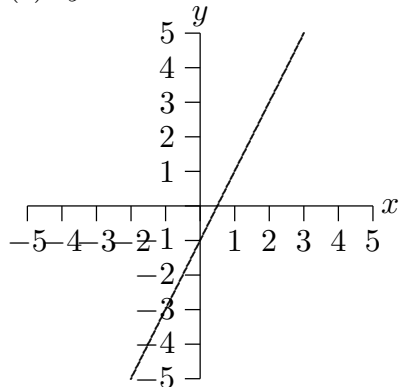
(c) $x = 3$ and $y = 2$



(d) $x = 3$ or $y = 2$

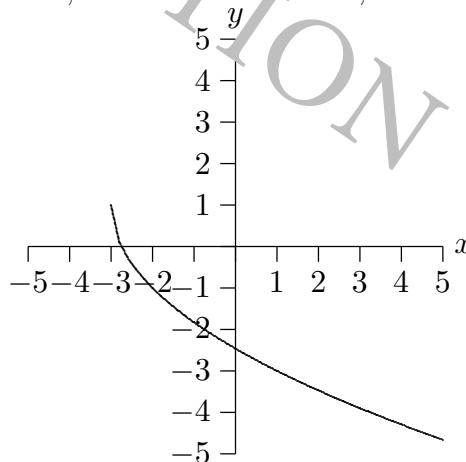


(e) $y = 2x - 1$

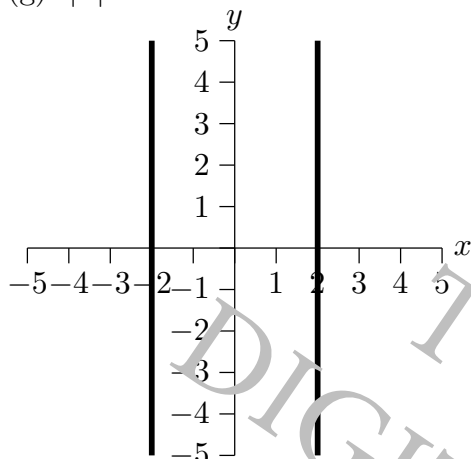


(f) $y = -2\sqrt{x+3} + 1$

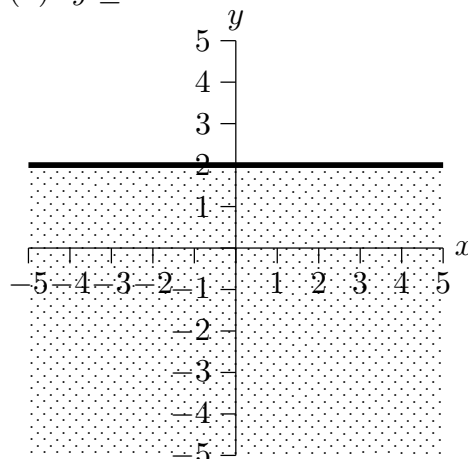
Take $y = \sqrt{x}$, and apply the following transformations: shift left 3; vertical stretch by a factor of 2; reflect about x -axis; move up 1. This gives:



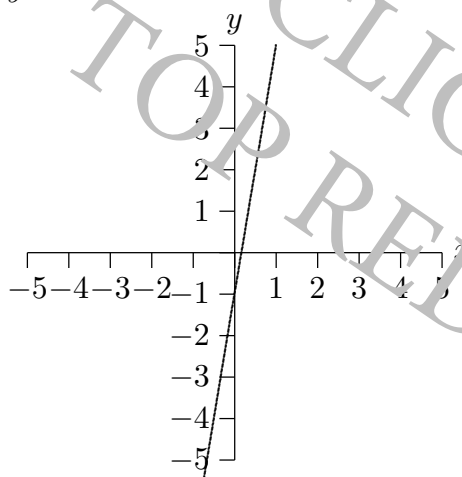
(g) $|x| = 2$



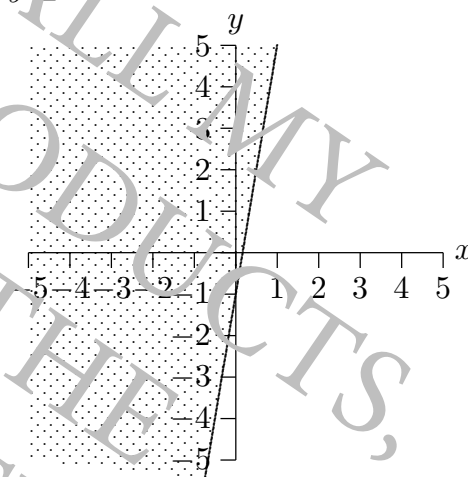
(h) $y \leq 2$



(i) $\frac{y-2}{3} = 2x - 1$ is equivalent to
 $y = 6x - 1$

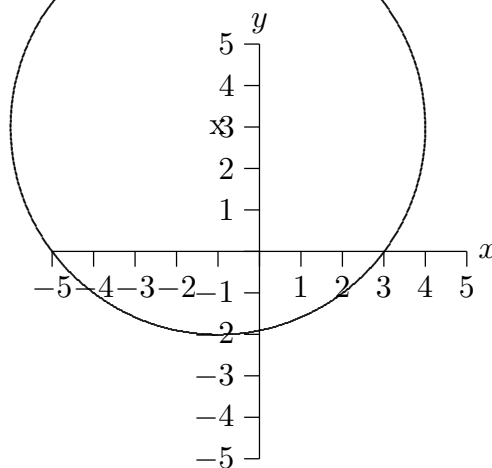


(j) $\frac{y-2}{3} \geq 2x - 1$ is equivalent to
 $y \geq 6x - 1$



(k) Complete the square and write as:

$$(x + 1)^2 + (y - 3)^2 = 25$$



4.

EQUATION	TRANSFORMATION
$y = f(x)$	(starting place)
$y = f(x + 1)$	replace x by $x + 1$; shift left 1
$y = f(x + 1) $	take absolute value of y -values; any part below x -axis flips up
$y = 3 f(x + 1) $	multiply previous y -values by 3; vertical stretch
$y = -3 f(x + 1) $	multiply previous y -values by -1 ; reflect about x -axis
$y = -3 f(x + 1) + 5$	add 5 to previous y -values; move up 5

5.

EQUATION	TRANSFORMATION
$y = x^2 - 2x + 1$	(starting place)
$y = x^2 - 2x + 2$	up 1
$y = (x + 3)^2 - 2(x + 3) + 2$	left 3
$y = -(x + 3)^2 + 2(x + 3) - 2$	reflect about the x -axis
$y = -2(x + 3)^2 + 4(x + 3) - 4$	vertical scale by a factor of 2

6. PERIMETER = $2\ell + 2w$, AREA = ℓw

PERIMETER = $2x + y$, AREA = $\frac{1}{2}(y)\left(\frac{x}{2}\right) = \frac{1}{4}xy$

CIRCUMFERENCE = $2\pi r$, AREA = πr^2

VOLUME = (area of base)(height) = $\pi R^2 h$

Meter is a unit of length; cm^2 is a unit of area; cubic feet is a unit of volume.

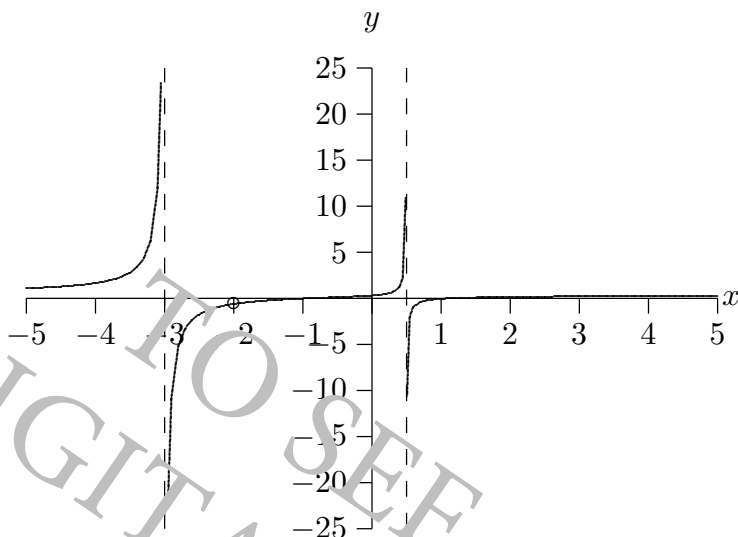
7.

$$\begin{aligned}
 \text{(a) } g(f(x)) &= g(x^2 - 2x + 1) \\
 &= 1 - 3(x^2 - 2x + 1) \\
 &= 1 - 3x^2 + 6x - 3 \\
 &= -3x^2 + 6x - 2
 \end{aligned}$$

$$\begin{aligned}
 f(g(x)) &= f(1 - 3x) \\
 &= (1 - 3x)^2 - 2(1 - 3x) + 1 \\
 &= 1 - 6x + 9x^2 - 2 + 6x + 1 \\
 &= 9x^2
 \end{aligned}$$

(b) (There are other possible correct answers.) Let $g(x) = x^2 - 1$ and $f(x) = \sqrt[3]{x}$.

8.



For $x \neq -2$, $g(x) = \frac{x^2 - 1}{(2x - 1)(x + 3)}$.

Note that the point $(-2, -\frac{3}{5})$ is a puncture point.

x -intercepts occur when $x = \pm 1$.

y -intercept: $(0, \frac{1}{3})$

horizontal asymptote: $y = \frac{1}{2}$

vertical asymptotes: $x = \frac{1}{2}$ and $x = -3$

no slant asymptote

As $x \rightarrow \infty$, $y \rightarrow \frac{1}{2}$.

As $x \rightarrow -3^+$, $y \rightarrow -\infty$.

9. Since $P(-3) = 0$, P has a factor of $x + 3$.

Since 1 is a zero of P , $x - 1$ is a factor.

Since the graph of P crosses the x -axis at $x = 2$, $x - 2$ is a factor.

Since P must have degree 5, I'll choose to make 1 a zero of multiplicity 3. (There are other possible choices here.) Thus, the polynomial takes on the following form:

$$P(x) = K(x + 3)(x - 1)^3(x - 2)$$

Since $P(0) = 7$, we have:

$$K(3)(-1)^3(-2) = 7$$

$$6K = 7$$

$$K = \frac{7}{6}$$

Thus, $P(x) = \frac{7}{6}(x + 3)(x - 1)^3(x - 2)$.

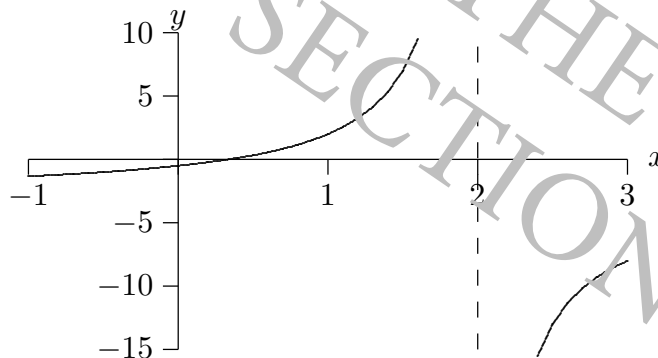
10. (a) $2x - 3$
 (b) $2(x - 3)$
 (c) $\frac{(2x)^3 + 1}{x}$
 (d) take a number, multiply by 3, then subtract 1
 (e) take a number, add 1, cube the result, multiply by 2, then subtract 5
 (f) take a number, subtract 3, divide by 7, then subtract 1

11. (a) $f(0) = 0^2 - 2(0) + 1 = 1$
 (b) $f(1) - 2 = (1^2 - 2 \cdot 1 + 1) - 2 = 0 - 2 = -2$
 (c) $f(f(-1)) = f((-1)^2 - 2(-1) + 1) = f(4) = 4^2 - 2(4) + 1 = 9$

12. The function g is defined whenever $x - 3 > 0$, that is, whenever $x > 3$.
 The domain of g is the interval $(3, \infty)$.

13. (a) $y = -3x - 7$
 (b) $y = 2$
 (c) The line $x + 3y = 5$ has slope $-\frac{1}{3}$; a perpendicular line will have slope 3 .
 The line with slope 3 passing through $(0, 3)$ has equation $y = 3x + 3$.

14. (a) The domain of f is the set of all real numbers except 2.
 (b)



- (c) The graph crosses the x -axis at $\frac{1}{3}$. (Set $1 - 3x = 0$. Be sure you can get this *exact* answer, not just $x \approx 0.333333$.)
 (d) When $x = 1.375$ (exactly), then $f(x) = 5$. (You could check this, if desired, by solving the equation $5 = \frac{1-3x}{x-2}$.)

15. (a) $\frac{1+\sqrt{2}}{\sqrt[3]{5}-7} \approx -0.45637$
 (b) 19.72 (this is exact)
 (c) $|1 - 2\sqrt{3}| \approx 2.46410$
 (d) $(2.03 \times 10^{-9})(-4.1 \times 10^7) = -0.08323$ (this is exact)