01a. Factor $12x^2 - 16x - 3$.

$12x^2 - 18x + 2x - 3$	2 pts to here
$6x(2x - 3) + (2x - 3)$	3 pts to here
$(2x - 3)(6x + 1)$	4 pts to here

01b. Factor $9x^2 - 6x - 8$.

$9x^2 - 12x + 6x - 8$	2 pts to here
$3x(3x - 4) + 2(3x - 4)$	3 pts to here
$(3x + 2)(3x - 4)$	4 pts to here

01c. Factor $4x^2 - 8x - 5$.

$4x^2 - 10x + 2x - 5$	2 pts to here
$2x(2x - 5) + (2x - 5)$	3 pts to here
$(2x - 5)(2x + 1)$	4 pts to here

01d. Factor $3x^2 - 2x - 8$.

$3x^2 - 6x + 4x - 8$	2 pts to here
$3x(x - 2) + 4(x - 2)$	3 pts to here
$(3x + 4)(x - 2)$	4 pts to here

02a. Factor $5ax + 10bx - ay - 2by$.

$5x(a + 2b) - y(a + 2b)$	2 pts to here
$(a + 2b)(5x - y)$	4 pts to here

02b. Factor $6ax + 48bx - ay - 8by$.

$6x(a + 8b) - y(a + 8b)$	2 pts to here
$(a + 8b)(6x - y)$	4 pts to here

02c. Factor $2ax - a - 2bx + b$.

$a(2x - 1) - b(2x - 1)$	2 pts to here
$(a - b)(2x - 1)$	4 pts to here

02d. Factor $5nz - n - 5mz + m$.

$n(5z - 1) - m(5z - 1)$	2 pts to here
$(n - m)(5z - 1)$	4 pts to here

03a. Simplify $\dfrac{x^3 + 5x^2}{x^2 - 2x - 35}$.

Partial factoring of only the numerator	1 pt
Partial factoring of only the denominator	2 pts
$\dfrac{x^2(x+5)}{(x-7)(x+5)}$	3 pts to here
$\dfrac{x^2}{x-7}$	4 pts to here

03b. Simplify $\dfrac{x^3+3x^2}{x^2-2x-15}$.

Partial factoring of only the numerator	1 pt
Partial factoring of only the denominator	2 pts
$\dfrac{x^2(x+3)}{(x-5)(x+3)}$	3 pts to here
$\dfrac{x^2}{x-5}$	4 pts to here

03c. Simplify $\dfrac{x^3-9x^2}{x^2-7x-18}$.

Partial factoring of only the numerator	1 pt
Partial factoring of only the denominator	2 pts
$\dfrac{x^2(x-9)}{(x-9)(x+2)}$	3 pts to here
$\dfrac{x^2}{x+2}$	4 pts to here

03d. Simplify $\dfrac{x^3-9x^2}{x^2-11x+18}$.

Partial factoring of only the numerator	1 pt
Partial factoring of only the denominator	2 pts
$\dfrac{x^2(x-9)}{(x-9)(x-2)}$	3 pts to here
$\dfrac{x^2}{x-2}$	4 pts to here

04a. Simplify $\dfrac{24x^3}{4x^2-16} \div \dfrac{8x^2}{x^2-4x+4}$.

Factoring of equivalent of one rational expression	1 pt
$\frac{24x^3}{4(x+2)(x-2)} \div \frac{8x^2}{(x-2)^2}$	2 pts to here
$\frac{24x^3}{4(x+2)(x-2)} \times \frac{(x-2)^2}{8x^2}$	3 pts to here
$\frac{3x(x-2)}{4(x+2)}$	4 pts to here

04b. Simplify $\dfrac{15x^3}{5x^2-20} \div \dfrac{10x^2}{x^2-4x+4}$.

Factoring of equivalent of one rational expression	1 pt
$\frac{15x^3}{5(x+2)(x-2)} \div \frac{10x^2}{(x-2)^2}$	2 pts to here
$\frac{15x^3}{5(x+2)(x-2)} \times \frac{(x-2)^2}{10x^2}$	3 pts to here
$\frac{3x(x-2)}{10(x+2)}$	4 pts to here

04c. Simplify $\dfrac{16x^3}{12x^2-12} \div \dfrac{8x^2}{x^2-2x+1}$.

Factoring of equivalent of one rational expression	1 pt
$\frac{16x^3}{12(x+1)(x-1)} \div \frac{8x^2}{(x-1)^2}$	2 pts to here
$\frac{16x^3}{12(x+1)(x-1)} \times \frac{(x-1)^2}{8x^2}$	3 pts to here
$\frac{x(x-1)}{6(x+1)}$	4 pts to here

04d. Simplify $\dfrac{32x^3}{8x^2-8} \div \dfrac{16x^2}{x^2-2x+1}$.

Factoring of equivalent of one rational expression	1 pt
$\frac{32x^3}{8(x+1)(x-1)} \div \frac{16x^2}{(x-1)^2}$	2 pts to here
$\frac{32x^3}{8(x+1)(x-1)} \times \frac{(x-1)^2}{16x^2}$	3 pts to here
$\frac{x(x-1)}{4(x+1)}$	4 pts to here

05a. Simplify $\dfrac{2}{x-8} - \dfrac{x}{x+3}$

$\frac{2(x+3)}{(x-8)(x+3)} - \frac{x(x-8)}{(x-8)(x+3)}$	1 pts to here
$\frac{2(x+3)-x(x-8)}{(x-8)(x+3)}$	2 pts to here
$\frac{2x+6-x^2+8x)}{(x-8)(x+3)}$	3 pts to here
$\frac{-x^2+10x+6}{(x-8)(x+3)}$	4 pts to here

05b. Simplify $\dfrac{3}{x-7} - \dfrac{x}{x+3}$

$\frac{3(x+3)}{(x-7)(x+3)} - \frac{x(x-7)}{(x-7)(x+3)}$	1 pts to here
$\frac{3(x+3)-x(x-7)}{(x-7)(x+3)}$	2 pts to here
$\frac{3x+9-x^2+7x)}{(x-7)(x+3)}$	3 pts to here
$\frac{-x^2+10x+9}{(x-7)(x+3)}$	4 pts to here

05c. Simplify $\dfrac{2}{x-6} - \dfrac{x}{x+2}$

$\frac{2(x+2)}{(x-6)(x+2)} - \frac{x(x-6)}{(x-6)(x+2)}$	1 pts to here
$\frac{2(x+2)-x(x-6)}{(x-6)(x+2)}$	2 pts to here
$\frac{2x+4-x^2+6x)}{(x-6)(x+2)}$	3 pts to here
$\frac{-x^2+8x+4}{(x-6)(x+2)}$	4 pts to here

05d. Simplify $\dfrac{4}{x-5} - \dfrac{x}{x+4}$

$\frac{4(x+4)}{(x-5)(x+4)} - \frac{x(x-5)}{(x-5)(x+4)}$	1 pts to here
$\frac{4(x+4)-x(x-5)}{(x-5)(x+4)}$	2 pts to here
$\frac{4x+16-x^2+5x)}{(x-5)(x+4)}$	3 pts to here
$\frac{-x^2+9x+16}{(x-5)(x+4)}$	4 pts to here

06a. Simplify $\dfrac{4x-9}{x^2-5x+6} + \dfrac{x+2}{x^2-8x+12}$.

$\frac{(4x-9)(x-6)}{(x-3)(x-2)(x-6)} + \frac{(x+2)(x-3)}{(x-6)(x-2)(x-3)}$	1 pt
$\frac{4x^2-33x+54+x^2-x-6}{(x-2)(x-6)(x-3)}$	2 pts to here
$\frac{5x^2-34x+48}{(x-2)(x-6)(x-3)}$	3 pts to here
$\frac{5x-24}{(x-6)(x-3)}$	4 pts to here

06b. Simplify $\dfrac{7x-16}{x^2-5x+6} + \dfrac{x+2}{x^2-6x+8}$.

$\frac{(7x-16)(x-4)}{(x-3)(x-2)(x-4)} + \frac{(x+2)(x-3)}{(x-4)(x-2)(x-3)}$	1 pt
$\frac{7x^2-44x+64+x^2-x-6}{(x-2)(x-4)(x-3)}$	2 pts to here
$\frac{8x^2-45x+58}{(x-2)(x-4)(x-3)}$	3 pts to here
$\frac{8x-29}{(x-4)(x-3)}$	4 pts to here

06c. Simplify $\dfrac{3x-8}{x^2-5x+6} + \dfrac{x+2}{x^2-6x+8}$.

$\frac{(3x-8)(x-4)}{(x-3)(x-2)(x-4)} + \frac{(x+2)(x-3)}{(x-4)(x-2)(x-3)}$	1 pt
$\frac{3x^2-12x+24+x^2-x-6}{(x-2)(x-4)(x-3)}$	2 pts to here
$\frac{4x^2-21x+26}{(x-2)(x-4)(x-3)}$	3 pts to here
$\frac{4x-13}{(x-4)(x-3)}$	4 pts to here

06d. Simplify $\dfrac{3x+5}{x^2+4x+3} + \dfrac{-x+5}{x^2+2x-3}$.

$\frac{(3x+5)(x-1)}{(x+1)(x+3)(x-1)} + \frac{(-x+5)(x+1)}{(x+3)(x-1)(x+1)}$	1 pt
$\frac{3x^2+2x-5-x^2+4x+5}{(x+3)(x-1)(x+1)}$	2 pts to here
$\frac{2x^2+6x}{(x+3)(x-1)(x+1)}$	3 pts to here
$\frac{2x}{(x-1)(x+1)}$	4 pts to here

07a. Simplify $\dfrac{\frac{a}{3b} - \frac{1}{2}}{\frac{7}{3b} - \frac{4}{a}}$.

Method 1	
$\frac{6ab}{6ab}\left(\frac{\frac{a}{3b} - \frac{1}{2}}{\frac{7}{3b} - \frac{4}{a}}\right)$	2 pts to here
$\frac{2a^2-3ab}{14a-24b}$	4 pts to here
Method 2	
$\frac{\frac{2a}{6b} - \frac{3b}{6b}}{\frac{7a}{3ab} - \frac{12b}{3ab}}$	1 pt to here
$\frac{\frac{2a-3b}{6b}}{\frac{7a-12b}{3ab}}$	2 pts to here
$\frac{2a-3b}{6b} \times \frac{3ab}{7a-12b}$	3 pts to here
$\frac{a(2a-3b)}{2(7a-12b)}$ or $\frac{2a^2-3ab}{14a-24b}$	4 pts to here

07b. Simplify $\dfrac{\frac{a}{5b} - \frac{1}{4}}{\frac{7}{5b} - \frac{3}{a}}$.

Method 1	
$\frac{20ab}{20ab}\left(\frac{\frac{a}{5b} - \frac{1}{4}}{\frac{7}{5b} - \frac{3}{a}}\right)$	2 pts to here
$\frac{4a^2-5ab}{28a-60b}$	4 pts to here
Method 2	
$\frac{\frac{4a}{20b} - \frac{5b}{20b}}{\frac{7a}{5ab} - \frac{15b}{5ab}}$	1 pt to here
$\frac{\frac{4a-5b}{20b}}{\frac{7a-15b}{5ab}}$	2 pts to here
$\frac{4a-5b}{20b} \times \frac{5ab}{7a-15b}$	3 pts to here
$\frac{a(4a-5b)}{4(7a-15b)}$ or $\frac{4a^2-5ab}{28a-60b}$	4 pts to here

07c. Simplify $\dfrac{\frac{a}{4b} - \frac{1}{3}}{\frac{5}{4b} - \frac{4}{a}}$.

Method 1	
$\frac{12ab}{12ab}(\frac{\frac{a}{4b}-\frac{1}{3}}{\frac{5}{4b}-\frac{4}{a}})$	2 pts to here
$\frac{3a^2-4ab}{15a-48b}$	4 pts to here
Method 2	
$\frac{\frac{3a}{12b}-\frac{4b}{12b}}{\frac{5a}{4ab}-\frac{16b}{4ab}}$	1 pt to here
$\frac{\frac{3a-4b}{12b}}{\frac{5a-16b}{4ab}}$	2 pts to here
$\frac{3a-4b}{12b} \times \frac{4ab}{5a-16b}$	3 pts to here
$\frac{a(3a-4b)}{3(5a-16b)}$ or $\frac{3a^2-4ab}{15a-48b}$	4 pts to here

07d. Simplify $\dfrac{\frac{a}{5b}-\frac{1}{4}}{\frac{3}{4b}-\frac{2}{a}}$.

Method 1	
$\frac{20ab}{20ab}(\frac{\frac{a}{5b}-\frac{1}{4}}{\frac{3}{4b}-\frac{2}{a}})$	2 pts to here
$\frac{4a^2-5ab}{15a-40b}$	4 pts to here
Method 2	
$\frac{\frac{4a}{20b}-\frac{5b}{20b}}{\frac{3a}{4ab}-\frac{8b}{4ab}}$	1 pt to here
$\frac{\frac{4a-5b}{12b}}{\frac{3a-8b}{4ab}}$	2 pts to here
$\frac{4a-5b}{12b} \times \frac{4ab}{3a-8b}$	3 pts to here
$\frac{a(4a-5b)}{5(3a-8b)}$ or $\frac{4a^2-5ab}{15a-40b}$	4 pts to here

08a. Solve $\dfrac{2}{x^2-4}+\dfrac{5}{x+2}=\dfrac{2}{x-2}$.

$2+5(x-2)=2(x+2)$	2 pts to here
$5x-8=2x+4$	3 pts to here
$x=4$	4 pts to here

08b. Solve $\dfrac{2}{x^2-1}+\dfrac{5}{x+1}=\dfrac{3}{x-1}$.

$2+5(x-1)=3(x+1)$	2 pts to here
$5x-3=3x+3$	3 pts to here
$x=3$	4 pts to here

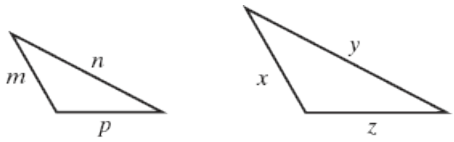
08c. Solve $\dfrac{4}{x^2-1}+\dfrac{7}{x+1}=\dfrac{5}{x-1}$.

$4+7(x-1)=5(x+1)$	2 pts to here
$7x-3=5x+5$	3 pts to here
$x=4$	4 pts to here

08d. Solve $\dfrac{x-1}{x^2-4} = \dfrac{2}{x+2} + \dfrac{4}{x-2}$.

$x - 1 = 2(x-2) + 4(x+2)$	2 pts to here
$x - 1 = 6x + 4$	3 pts to here
$x = -1$	4 pts to here

09a. Triangles A and B are similar.

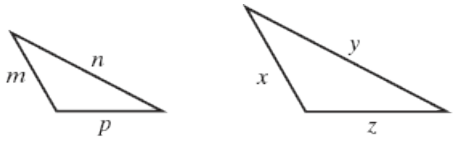


Triangle A Triangle B

If $x = 21$ in., $y = 23$ in., and $m = 19$ in., find the length of side n. Leave your answer as a fraction.

$\frac{19}{21} = \frac{n}{23}$ or $\frac{19}{n} = \frac{21}{23}$ or $\frac{21}{19} = \frac{23}{n}$ or $\frac{n}{19} = \frac{23}{21}$	2 pts to here
$n = \frac{437}{21}$ inches or $n = 20\frac{17}{21}$ inches	4 pts to here
(3 pts for correct solution, but no units are given)	

09b. Triangles A and B are similar.

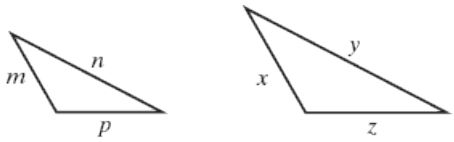


Triangle A Triangle B

If $x = 21$ in., $y = 29$ in., and $m = 17$ in., find the length of side n. Leave your answer as a fraction.

$\frac{17}{21} = \frac{n}{29}$ or $\frac{17}{n} = \frac{21}{29}$ or $\frac{21}{17} = \frac{29}{n}$ or $\frac{n}{17} = \frac{29}{21}$	2 pts to here
$n = \frac{493}{21}$ inches or $n = 23\frac{10}{21}$ inches	4 pts to here
(3 pts for correct solution, but no units are given)	

09c. Triangles A and B are similar.

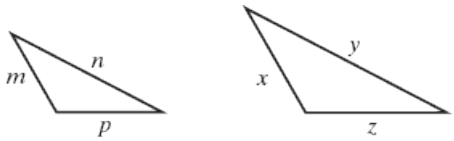


Triangle A Triangle B

If $x = 20$ in., $y = 29$ in., and $m = 13$ in., find the length of side y. Leave your answer as a fraction.

$\frac{13}{20} = \frac{n}{29}$ or $\frac{13}{n} = \frac{20}{29}$ or $\frac{20}{13} = \frac{29}{n}$ or $\frac{n}{13} = \frac{20}{29}$	2 pts to here
$n = \frac{377}{20}$ inches or $n = 18\frac{17}{20}$ inches	4 pts to here
(3 pts for correct solution, but no units are given)	

09d. Triangles A and B are similar.



Triangle A Triangle B

If $z = 18$ in., $y = 25$ in., and $n = 9$ in., find the length of side p. Leave your answer as a fraction.

$\frac{9}{25} = \frac{p}{18}$ or $\frac{9}{p} = \frac{25}{18}$ or $\frac{25}{9} = \frac{18}{p}$ or $\frac{p}{9} = \frac{18}{25}$	2 pts to here
$p = \frac{162}{25}$ inches or $p = 6\frac{12}{25}$ inches	4 pts to here
(3 pts for correct solution, but no units are given)	

10a. Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{45x} - \sqrt{128x} + \sqrt{72x}$.

$3\sqrt{5x} - 8\sqrt{2x} + 6\sqrt{2x}$	2 pts to here
$3\sqrt{5x} - 2\sqrt{2x}$	4 pts to here

10b. Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{28x} - \sqrt{147x} + \sqrt{75x}$

$2\sqrt{7x} - 7\sqrt{3x} + 5\sqrt{3x}$	2 pts to here
$2\sqrt{7x} - 2\sqrt{3x}$	4 pts to here

10c. Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{63x} - \sqrt{54x} + \sqrt{24x}$

$3\sqrt{7x} - 3\sqrt{6x} + 2\sqrt{6x}$	2 pts to here
$3\sqrt{7x} - \sqrt{6x}$	4 pts to here

10d. Combine. Assume that all variables represent nonnegative real numbers. $\sqrt{44x} - \sqrt{63x} + \sqrt{112x}$

$2\sqrt{11x} - 3\sqrt{7x} + 4\sqrt{7x}$	2 pts to here
$2\sqrt{11x} + \sqrt{7x}$	4 pts to here

11a. Simplify $\dfrac{\sqrt{3}+3}{\sqrt{3}-3}$.

$\frac{\sqrt{3}+3}{\sqrt{3}-3} \times \frac{\sqrt{3}+3}{\sqrt{3}+3}$	2 pts to here
$\frac{3+3\sqrt{3}+3\sqrt{3}+9}{3-9}$	3 pts to here
$\frac{12+6\sqrt{3}}{-6}$	
$-2 - \sqrt{3}$	4 pts to here

11b. Simplify $\dfrac{\sqrt{5}+3}{\sqrt{5}-3}$.

$\frac{\sqrt{5}+3}{\sqrt{5}-3} \times \frac{\sqrt{5}+3}{\sqrt{5}+3}$	2 pts to here
$\frac{5+3\sqrt{5}+3\sqrt{5}+9}{5-9}$	3 pts to here
$\frac{14+6\sqrt{3}}{-4}$	
$\frac{-7-3\sqrt{5}}{-2}$	4 pts to here

11c. Simplify $\dfrac{\sqrt{5}-3}{\sqrt{5}+3}$.

$\frac{\sqrt{5}-3}{\sqrt{5}+3} \times \frac{\sqrt{5}-3}{\sqrt{5}-3}$	2 pts to here
$\frac{5-3\sqrt{5}-3\sqrt{5}+9}{5-9}$	3 pts to here
$\frac{14-6\sqrt{3}}{-4}$	
$\frac{-7+3\sqrt{5}}{-2}$	4 pts to here

11d. Simplify $\dfrac{\sqrt{3}-3}{\sqrt{3}+3}$.

$\frac{\sqrt{3}-3}{\sqrt{3}+3} \times \frac{\sqrt{3}-3}{\sqrt{3}-3}$	2 pts to here
$\frac{3-3\sqrt{3}-3\sqrt{3}+9}{3-9}$	3 pts to here
$\frac{12-6\sqrt{3}}{-6}$	
$-2 + \sqrt{3}$	4 pts to here

12a. Solve $\sqrt{x+8} - 8 = x$.

$\sqrt{x+8} = x + 8$	
$x + 8 = x^2 + 16x + 64$	1 pt to here
$0 = x^2 + 15x + 56$	2 pts to here
$0 = (x+7)(x+8)$	3 pts to here
$x = -7$ and $x = -8$	4 pts to here

12b. Solve $\sqrt{x+9} - 9 = x$.

$\sqrt{x+9} = x+9$	
$x+9 = x^2+18x+81$	1 pt to here
$0 = x^2+17x+72$	2 pts to here
$0 = (x+9)(x+8)$	3 pts to here
$x = -9$ and $x = -8$	4 pts to here

12c. Solve $\sqrt{x+10} - 10 = x$.

$\sqrt{x+10} = x+10$	
$x+10 = x^2+20x+100$	1 pt to here
$0 = x^2+19x+90$	2 pts to here
$0 = (x+9)(x+10)$	3 pts to here
$x = -9$ and $x = -10$	4 pts to here

12d. Solve $\sqrt{x+7} - 7 = x$.

$\sqrt{x+7} = x+7$	
$x+7 = x^2+14x+49$	1 pt to here
$0 = x^2+13x+42$	2 pts to here
$0 = (x+6)(x+7)$	3 pts to here
$x = -6$ and $x = -7$	4 pts to here

13a. Simplify $\sqrt{-16}$.

$\sqrt{-1}\sqrt{16}$	1 pts to here
$4\sqrt{-1}$	2 pts to here or
$i\sqrt{16}$	3 pts to here
$4i$	4 pts to here

13b. Simplify $\sqrt{-25}$.

$\sqrt{-1}\sqrt{25}$	1 pts to here
$5\sqrt{-1}$	2 pts to here or
$i\sqrt{25}$	3 pts to here
$5i$	4 pts to here

13c. Simplify $\sqrt{-9}$.

$\sqrt{-1}\sqrt{9}$	1 pts to here
$3\sqrt{-1}$	2 pts to here or
$i\sqrt{9}$	3 pts to here
$3i$	4 pts to here

13d. Simplify $\sqrt{-36}$.

$\sqrt{-1}\sqrt{36}$	1 pts to here
$6\sqrt{-1}$	2 pts to here or
$i\sqrt{36}$	3 pts to here
$6i$	4 pts to here

14a. y varies directly as x and inversely as the square of z. If $y = 84$ when $x = 54$ and $z = 3$, find y when $x = 48$ and $z = 4$.

$y = \frac{kx}{z^2}$	
$84 = \frac{k(54)}{3^2}$	1 pt to here
$84 = 6k$	
$14 = k$	2 pts to here
$y = \frac{14x}{z^2}$	
$y = \frac{14(48)}{4^2}$	3 pts to here
$y = 42$	4 pts to here

14b. y varies directly as x and inversely as the square of z. If $y = 64$ when $x = 32$ and $z = 4$, find y when $x = 75$ and $z = 5$.

$y = \frac{kx}{z^2}$	
$64 = \frac{k(32)}{4^2}$	1 pt to here
$64 = 2k$	
$32 = k$	2 pts to here
$y = \frac{32x}{z^2}$	
$y = \frac{32(75)}{5^2}$	3 pts to here
$y = 96$	4 pts to here

14c. y varies directly as x and inversely as the square of z. If $y = 56$ when $x = 175$ and $z = 5$, find y when $x = 98$ and $z = 7$.

$y = \frac{kx}{z^2}$	
$56 = \frac{k(175)}{5^2}$	1 pt to here
$56 = 7k$	
$8 = k$	2 pts to here
$y = \frac{8x}{z^2}$	
$y = \frac{8(98)}{7^2}$	3 pts to here
$y = 16$	4 pts to here

14d. y varies directly as x and inversely as the square of z. If $y = 84$ when $x = 64$ and $z = 4$, find y when $x = 12$ and $z = 2$.

$y = \frac{kx}{z^2}$	
$84 = \frac{k(64)}{4^2}$	1 pt to here
$84 = 4k$	
$21 = k$	2 pts to here
$y = \frac{21x}{z^2}$	
$y = \frac{21(12)}{2^2}$	3 pts to here
$y = 63$	4 pts to here

15a. Solve by using the square root property. $(2x + 7)^2 = 81$.

$2x + 7 = \pm 9$	1 pt to here
$2x = 2$	
$x = 1$	2 pts to here
$2x = -16$	3 pts to here
$x = -8$	4 pts

15b. Solve by using the square root property. $(2x + 7)^2 = 121$.

$2x + 7 = \pm 11$	1 pt to here
$2x = 4$	
$x = 2$	2 pts to here
$2x = -18$	3 pts to here
$x = -9$	4 pts

15c. Solve by using the square root property. $(2x + 3)^2 = 81$.

$2x + 3 = \pm 9$	1 pt to here
$2x = 6$	
$x = 3$	2 pts to here
$2x = -12$	3 pts to here
$x = -6$	4 pts

15d. Solve by using the square root property. $(2x + 5)^2 = 81$.

$2x + 5 = \pm 9$	1 pt to here
$2x = 4$	
$x = 2$	2 pts to here
$2x = -14$	3 pts to here
$x = -7$	4 pts

16a. A company that manufactures bikes makes a daily profit, P, according to the equation $P(x) = -100x^2 + 5000x - 55444$ where P is measured in dollars and x is the number of mountain bikes made per day. Find the number of mountain bikes that must be made each day to produce a zero profit for the company. Round your answer to the nearest whole number.

$x = \frac{-5000 \pm \sqrt{(5000)^2 - 4(-100)(-55444)}}{2(-100)}$	1 pt to here
$x = \frac{-5000 \pm \sqrt{2822400}}{-200}$	2 pts to here
$x = \frac{-5000+1680}{-200} = 16.6 \approx 17$ bikes	3 pts to here
$x = \frac{-5000-1680}{-200} = 33.4 \approx 33$ bikes	4 pts to here (3 pts if no units)

16b. A company that manufactures bikes makes a daily profit, P, according to the equation $P(x) = -100x^2 + 4700x - 49449$ where P is measured in dollars and x is the number of mountain bikes made per day. Find the number of mountain bikes that must be made each day to produce a zero profit for the company. Round your answer to the nearest whole number.

$x = \frac{-4700 \pm \sqrt{(4700)^2 - 4(-100)(-49449)}}{2(-100)}$	1 pt to here
$x = \frac{-4700 \pm \sqrt{2310400}}{-200}$	2 pts to here
$x = \frac{-4700+1520}{-200} = 15.9 \approx 16$ bikes	3 pts to here
$x = \frac{-4700-1520}{-200} = 31.1 \approx 31$ bikes	4 pts to here (3 pts if no units)

16c. A company that manufactures bikes makes a daily profit, P, according to the equation $P(x) = -100x^2 + 4200x - 43371$ where P is measured in dollars and x is the number of mountain bikes made per day. Find the number of mountain bikes that must be made each day to produce a zero profit for the company. Round your answer to the nearest whole number.

$x = \frac{-4200 \pm \sqrt{(4200)^2 - 4(-100)(-43371)}}{2(-100)}$	1 pt to here
$x = \frac{-4200 \pm \sqrt{291600}}{-200}$	2 pts to here
$x = \frac{-4200+540}{-200} = 18.3 \approx 18$ bikes	3 pts to here
$x = \frac{-4200-540}{-200} = 23.7 \approx 24$ bikes	4 pts to here (3 pts if no units)

16d. A company that manufactures bikes makes a daily profit, P, according to the equation $P(x) = -100x^2 - 4500x - 48509$ where P is measured in dollars and x is the number of mountain bikes made per day. Find the number of mountain bikes that must be made each day to produce a zero profit for the company. Round your answer to the nearest whole number.

$x = \frac{-4500 \pm \sqrt{(4500)^2 - 4(-100)(-48509)}}{2(-100)}$	1 pt to here
$x = \frac{-4500 \pm \sqrt{846400}}{-200}$	2 pts to here
$x = \frac{-4500+920}{-200} = 17.9 \approx 18$ bikes	3 pts to here
$x = \frac{-4500-920}{-200} = 27.1 \approx 27$ bikes	4 pts to here (3 pts if no units)

17a. A brace for a shelf has the shape of a right triangle. Its hypotenuse is 10 inches long and the two legs are equal in length. How long are the legs of the triangle? Keep answers in simplified radical form.

$x^2 + x^2 = 10^2$	1 pt to here
$x^2 = 50$	2 pts to here
$x = \sqrt{50}$ or $x = \pm\sqrt{50}$	3 pts to here
$x = 5\sqrt{2}$ in.	4 pts to here (3 pts no units)

17b. A brace for a shelf has the shape of a right triangle. Its hypotenuse is 8 inches long and the two legs are equal in length. How long are the legs of the triangle? Keep answers in simplified radical form.

$x^2 + x^2 = 8^2$	1 pt to here
$x^2 = 32$	2 pts to here
$x = \sqrt{32}$ or $x = \pm\sqrt{32}$	3 pts to here
$x = 4\sqrt{2}$ in.	4 pts to here (3 pts no units)

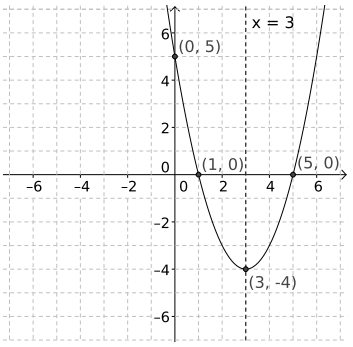
17c. A brace for a shelf has the shape of a right triangle. Its hypotenuse is 18 inches long and the two legs are equal in length. How long are the legs of the triangle? Keep answers in simplified radical form.

$x^2 + x^2 = 18^2$	1 pt to here
$x^2 = 162$	2 pts to here
$x = \sqrt{162}$ or $x = \pm\sqrt{162}$	3 pts to here
$x = 9\sqrt{2}$ in.	4 pts to here (3 pts no units)

17d. A brace for a shelf has the shape of a right triangle. Its hypotenuse is 26 inches long and the two legs are equal in length. How long are the legs of the triangle? Keep answers in simplified radical form.

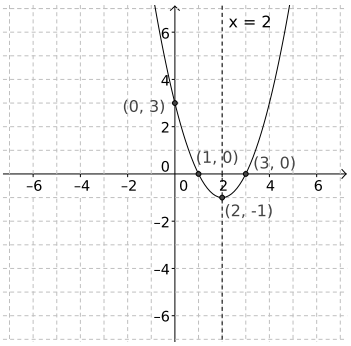
$x^2 + x^2 = 26^2$	1 pt to here
$x^2 = 338$	2 pts to here
$x = \sqrt{338}$ or $x = \pm\sqrt{338}$	3 pts to here
$x = 13\sqrt{2}$ in.	4 pts to here (3 pts no units)

18a. Given $f(x) = x^2 - 6x + 5$. Identify the vertex, y-intercept, x-intercept(s), axis of symmetry, and graph the function on the graph paper and label your findings on it.



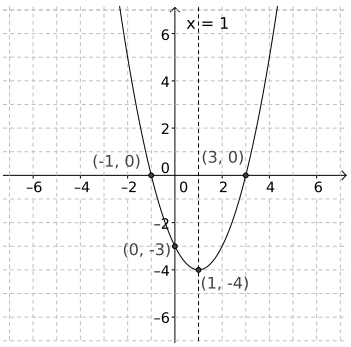
vertex $(3, -4)$	Add 1 pt
x-intercepts $(5, 0)$, $(1, 0)$	Add 1 pt for each
y-intercept $(0, 5)$	Add 1 pt
Axis of Symmetry $x = 3$	Add 1 pt
Correct graph	Add 1 pt
All of the points above marked on the graph	Add 2 pts

18b. Given $f(x) = x^2 - 4x + 3$. Identify the vertex, y-intercept, x-intercept(s), axis of symmetry, and graph the function on the graph paper and label your findings on it.



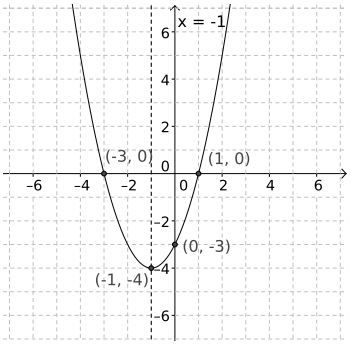
vertex $(2, -1)$	Add 1 pt
x-intercepts $(1, 0)$, $(3, 0)$	Add 1 pt for each
y-intercept $(0, 3)$	Add 1 pt
Axis of Symmetry $x = 2$	Add 1 pt
Correct graph	Add 1 pt
All of the points above marked on the graph	Add 2 pts

18c. Given $f(x) = x^2 - 2x - 3$. Identify the vertex, y-intercept, x-intercept(s), axis of symmetry, and graph the function on the graph paper and label your findings on it.



vertex $(1, -4)$	Add 1 pt
x-intercepts $(-1, 0)$, $(3, 0)$	Add 1 pt for each
y-intercept $(0, -3)$	Add 1 pt
Axis of Symmetry $x = 1$	Add 1 pt
Correct graph	Add 1 pt
All of the points above marked on the graph	Add 2 pts

18d. Given $f(x) = x^2 + 2x - 3$. Identify the vertex, y-intercept, x-intercept(s), axis of symmetry, and graph the function on the graph paper and label your findings on it.



vertex $(-1, -4)$	Add 1 pt
x-intercepts $(-3, 0)$, $(1, 0)$	Add 1 pt for each
y-intercept $(0, -3)$	Add 1 pt
Axis of Symmetry $x = -1$	Add 1 pt
Correct graph	Add 1 pt
All of the points above marked on the graph	Add 2 pts

19a. Solve $|x + 2| - 1 = 6$.

$\|x + 2\| = 7$	1 pt
$x + 2 = 7$	
$x = 5$	2 pt
$x + 2 = -7$	3 pt to here
$x = -9$	4 pt to here

19b. Solve $|x + 5| - 3 = 10$.

$\|x + 5\| = 13$	1 pt
$x + 5 = 13$	
$x = 8$	2 pt
$x + 5 = -13$	3 pt to here
$x = -18$	4 pt to here

19c. Solve $|x-5|+4=12$.

$\lvert x-5\rvert = 8$	1 pt
$x-5=8$	
$x=13$	2 pt
$x-5=-8$	3 pt to here
$x=-3$	4 pt to here

19d. Solve $|x-3|+2=13$.

$\lvert x-3\rvert = 11$	1 pt
$x-3=11$	
$x=14$	2 pt
$x-3=-11$	3 pt to here
$x=-8$	4 pt to here

20a. Find the distance between $(3,-6)$ and $(-1,-9)$.

$d=\sqrt{(-1-3)^2+(-9-(-6))^2}$	
$d=\sqrt{(-4)^2+(-3)^2}$	1 pts to here
$d=\sqrt{16+9}$	2 pts to here
$d=\sqrt{25}$	3 pts to here
$d=5$	4 pts to here

20b. Find the distance between $(1,-3)$ and $(-11,-8)$.

$d=\sqrt{(1-(-11))^2+(-3-(-8))^2}$	
$d=\sqrt{(12)^2+(5)^2}$	1 pts to here
$d=\sqrt{144+25}$	2 pts to here
$d=\sqrt{169}$	3 pts to here
$d=13$	4 pts to here

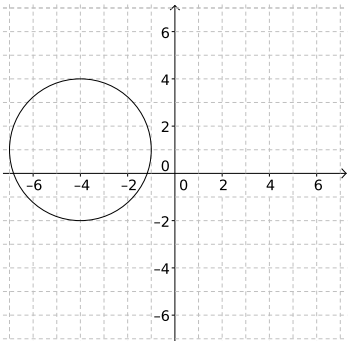
20c. Find the distance between $(4,-5)$ and $(-2,-13)$.

$d=\sqrt{(4-(-2))^2+(-5-(-13))^2}$	
$d=\sqrt{(6)^2+(8)^2}$	1 pts to here
$d=\sqrt{36+64}$	2 pts to here
$d=\sqrt{100}$	3 pts to here
$d=10$	4 pts to here

20d. Find the distance between $(-7,13)$ and $(-12,1)$.

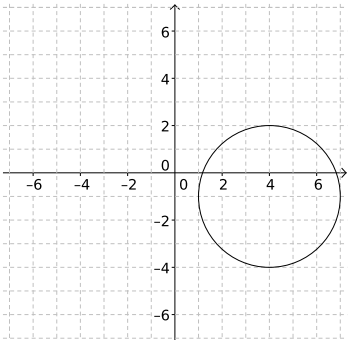
$d=\sqrt{(-7-(-12))^2+(13-1)^2}$	
$d=\sqrt{(5)^2+(12)^2}$	1 pts to here
$d=\sqrt{25+144}$	2 pts to here
$d=\sqrt{169}$	3 pts to here
$d=13$	4 pts to here

21a. Find the center and radius, and graph the circle $(x+4)^2+(y-1)^2=9$.



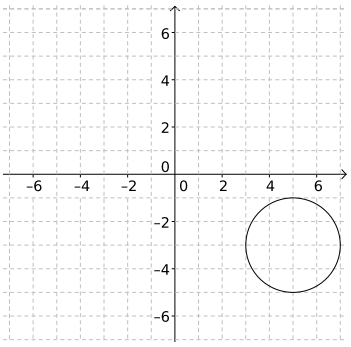
Correct graph	Add 2 points
Center $(-4,1)$	Add 1 point
Radius 3	Add 1 point

21b. Find the center and radius, and graph the circle $(x-4)^2+(y+1)^2=9$.



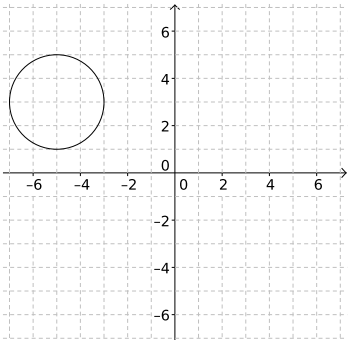
Correct graph	Add 2 points
Center $(4,-1)$	Add 1 point
Radius 3	Add 1 point

21c. Find the center and radius, and graph the circle $(x-5)^2+(y+3)^2=4$.



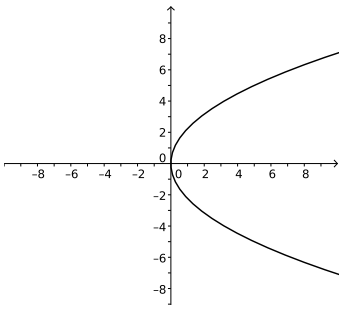
Correct graph	Add 2 points
Center $(5, -3)$	Add 1 point
Radius 2	Add 1 point

21d. Find the center and radius, and graph the circle $(x+5)^2 + (y-3)^2 = 4$.

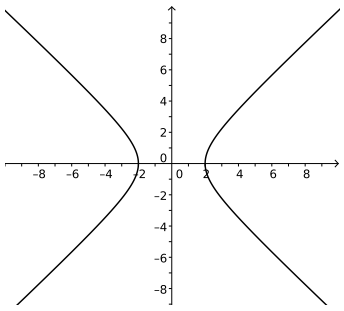


Correct graph	Add 2 points
Center $(-5, 3)$	Add 1 point
Radius 2	Add 1 point

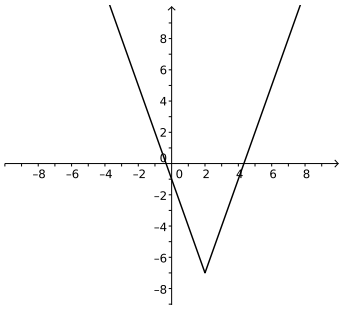
22a. Determine whether each graph represents a function.



Yes or No



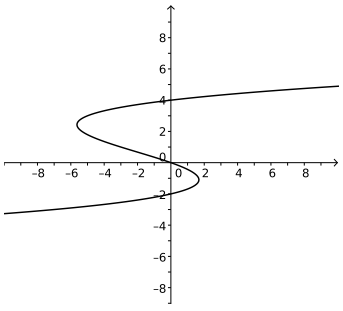
Yes or No



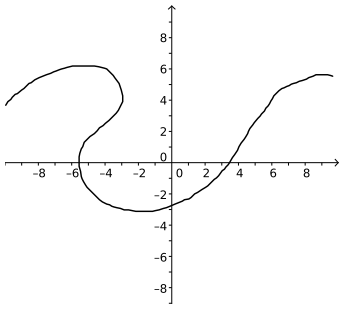
Yes or No

No (1 pt)	No (1 pt)	Yes (1 pt)
Add 1 point if all 3 correct		

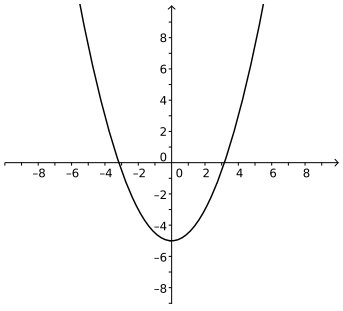
22b. Determine whether each graph represents a function.



Yes or No



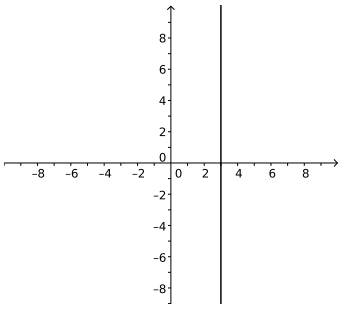
Yes or No



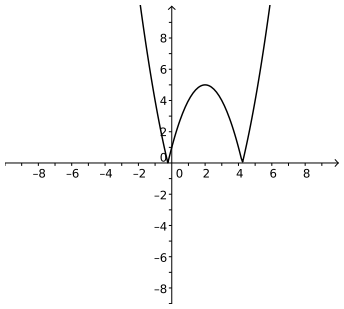
Yes or No

No (1 pt) No (1 pt) Yes (1 pt) Add 1 point if all 3 correct

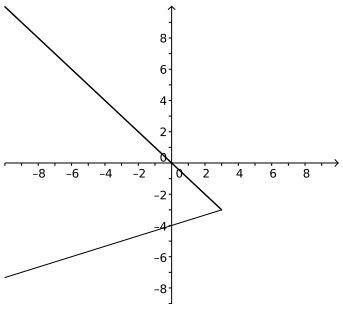
22c. Determine whether each graph represents a function.



Yes or No



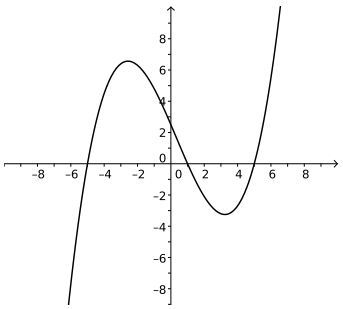
Yes or No



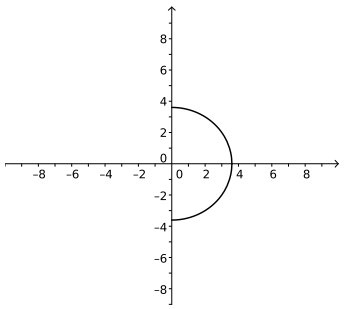
Yes or No

No (1 pt) Yes (1 pt) No (1 pt) Add 1 point if all 3 correct

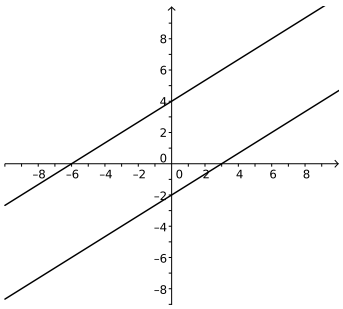
22d. Determine whether each graph represents a function.



Yes or No



Yes or No



Yes or No

Yes (1 pt) No (1 pt) No (1 pt) Add 1 point if all 3 correct

23a. Given $f(x) = 4x - 7$, find $f(a - 6)$.

$4(a-6)-7$	2 pt
$4a-24-7$	3 pts to here
$4a-31$	4 pts to here

23b. Given $f(x) = 5x - 4$, find $f(a - 6)$.

$5(a-6)-4$	2 pt
$5a-30-4$	3 pts to here
$5a-34$	4 pts to here

23c. Given $f(x) = 3x - 6$, find $f(a - 6)$.

$3(a-6)-6$	2 pt
$3a-18-6$	3 pts to here
$3a-24$	4 pts to here

23d. Given $f(x) = 4x - 7$, find $f(a - 6)$.

$4(a-6)-7$	2 pt
$4a-24-7$	3 pts to here
$4a-31$	4 pts to here

24a. Find the difference quotient of f; that is find $\dfrac{f(x+h)-f(x)}{h}$. Assume $h \neq 0$. $f(x) = 5x + 8$.

$f(x+h) = 5x+5h+8$	1 pt
$\frac{(5x+5h+8)-(5x+8)}{h}$	2 pts to here
$\frac{5h}{h}$	3 pts to here
5	4 pts to here

24b. Find the difference quotient of f; that is find $\dfrac{f(x+h)-f(x)}{h}$. Assume $h \neq 0$. $f(x) = 3x + 5$.

$f(x+h) = 3x+3h+5$	1 pt
$\frac{(3x+3h+5)-(3x+5)}{h}$	2 pts to here
$\frac{3h}{h}$	3 pts to here
3	4 pts to here

24c. Find the difference quotient of f; that is find $\dfrac{f(x+h)-f(x)}{h}$. Assume $h \neq 0$. $f(x) = 4x + 3$.

$f(x+h) = 4x+4h+3$	1 pt
$\frac{(4x+4h+3)-(4x+3)}{h}$	2 pts to here
$\frac{4h}{h}$	3 pts to here
4	4 pts to here

24d. Find the difference quotient of f; that is find $\dfrac{f(x+h)-f(x)}{h}$. Assume $h \neq 0$. $f(x) = 6x + 7$.

$f(x+h) = 6x+6h+7$	1 pt
$\frac{(6x+6h+7)-(6x+7)}{h}$	2 pts to here
$\frac{6h}{h}$	3 pts to here
6	4 pts to here