

1. Solve each of the following inequalities.

a) $x^2 - 3x + 2 > 0$ b) $\frac{x-1}{x-2} > 0$ c) $x^2 - 4 \leq 0$ d) $\frac{x-2}{x+2} \leq 0$ e) $\frac{2x-1}{x-3} \leq 3$

2. If we take Q amount of a certain medication, the amount of it in our system, t hours after intake is

$$A(t) = Q \left(\frac{3}{4} \right)^{0.8t}$$

- a) Approximately what percent of the medication is in our system 2 hours after taking it?
 b) How long until we have only 20% left in our system?
 c) How long until we have only 1% left in our system?
3. The number of cells in a sample at time t (measured in hours) is $N(t) = 20\,000(1.2^{0.5t})$. How long will it take for the sample to double?
4. In each case, state the discontinuities of the given rational function. Classify them as holes or vertical asymptotes.

a) $f(x) = \frac{x^2 - 25}{x^2 - 5x}$ b) $g(x) = \frac{(x+1)^2 x (x-1)^2}{x^2 + 4x + 13}$ c) $h(x) = \frac{-2(x+5)(x+3)^5 x (x-1)^2 (x-4)^2}{(x+6)(x+3)^2 x^3 (x-1)^2 (x-4)^6}$

5. Compute each of the following limits. Show all steps for part a).

a) $\lim_{x \rightarrow -\infty} \frac{3x^5 - 2x^2 + 5x - 9}{-7x^2 + 3x + 1}$ d) $\lim_{x \rightarrow \infty} \frac{3x^5 - x^2 + 7x}{2x^5 + x^4 - 1}$ g) $\lim_{x \rightarrow -\infty} \frac{2x(x-3)^2}{-4(x+1)^3}$
 b) $\lim_{x \rightarrow \infty} \frac{3x^5 - 2x^2 + 5x - 9}{-7x^2 + 3x + 1}$ e) $\lim_{x \rightarrow -\infty} \frac{-2x^5 - x^2 + 7x}{-4x^9 + x^6 + 10x}$ h) $\lim_{x \rightarrow \infty} \frac{5(x+4)x^2(x-3)^2}{-4(x-1)^3}$
 c) $\lim_{x \rightarrow -\infty} \frac{3x^5 - x^2 + 7x}{2x^5 + x^4 - 1}$ f) $\lim_{x \rightarrow \infty} \frac{-2x^5 - x^2 + 7x}{-4x^9 + x^6 + 10x}$

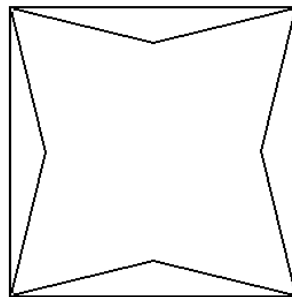
6. Solve each of the following triangles.

a) $b = 12$, $\alpha = 25^\circ$, and $\beta = 100^\circ$ c) $a = 21$ $b = 25$ $\alpha = 40^\circ$
 b) $a = 6$, $b = 16$, and $\beta = 42^\circ$ d) $a = 6$ $b = 20$ $\alpha = 40^\circ$

7. Solve the equation $x^6 - 4x^5 + 3x^4 + 4x^3 - 4x^2 = 0$ if we know that $x = 2$ is a solution of this equation.

8. In triangle ABC , $\gamma = 90^\circ$ and $\cos \alpha = \frac{4}{5}$. If D is the midpoint of side AC , find the exact value of the cosine of angle CDB .

9. Consider a square with sides 1 unit long. To the inside of each side, we draw an isosceles triangle with its greatest angle, opposite the unit long base, measures 150° . Consider all vertices of these triangles that are not on the square. If we connect these vertices, we obtain a square. Compute the exact value of the area of this square.



10. Solve each of the following equations.

a) $2^{2x-3} = 32$

d) $2^{x+1} - 5 \cdot 2^{x-1} = -3$

g) $\cos x = \cos x \sin x$

b) $3^{5x+1} = 32$

e) $2 \cdot 4^{x+1} - 65 \cdot 2^x + 8 = 0$

h) $\tan^3 x = 3 \tan x$

c) $2^{2x-3} = 5^{3-x}$

f) $1 - \cos x = 2 \sin^2 x$

i) $\log_2(x+1) + \log_2(x+5) = 5$

11. Point D is on side AB of triangle ABC , with $\angle ACD = \angle BCD = 60^\circ$, $AC = 5$, and $BC = 15$. Find the length of line segment CD .

12. Compute the exact value of the side of a regular triangle written into a circle with radius 1 unit.

13. Find the formula for the area of the regular n -gon written into a circle with radius r using

a) right triangle trigonometry

b) the formula $A = \frac{1}{2}ab \sin \gamma$

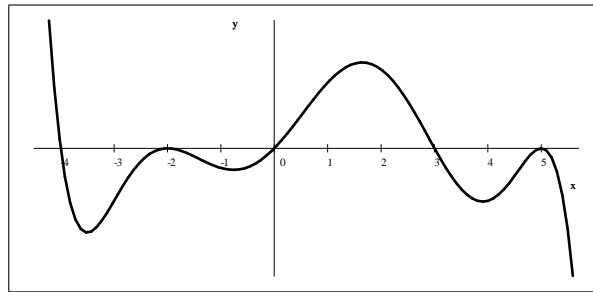
14. Find an equation for all tangent lines drawn to the graph of $y = -\frac{1}{2}x^2 - 4x + 7$ from the point $(-3, 15)$.

15. Sketch the graph of each of the following functions.

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

b) $f(x) = (-2-x)^2(-1-x)^3x(1-x)^2(2-x)$

16. Based on the graph below, find a possible equation for the polynomial function shown below.



17. Sketch the graph of each of the following.

a) $f(x) = x - 2$

d) $k(x) = (x-2)^4$

f) $g(x) = \frac{1}{(x-2)^2}$

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

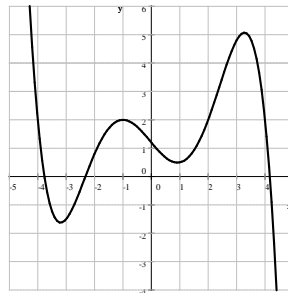
b) $g(x) = (x-2)^2$

c) $h(x) = (x-2)^3$

e) $f(x) = \frac{1}{x-2}$

g) $h(x) = \frac{1}{(x-2)^3}$

18. The picture below shows the graph of a function $f(x)$. Graph each of the following functions.



a) $g(x) = |f(x)|$

b) $h(x) = f(-x)$

c) $p(x) = \frac{f(x) + |f(x)|}{2}$

d) $q(x) = f(x) \cdot \frac{x-2}{x-2}$

Answers

1.) a) $(-\infty, 1) \cup (2, \infty)$ b) $(-\infty, 1) \cup (2, \infty)$ c) $[-2, 2]$ d) $(-2, 2]$ e) $(-\infty, 3) \cup [8, \infty)$

2.) a) 63.11% b) 6.99 hours c) 20 hours 3.) 7.604 hours

4.) a) discontinuities: at $x = 0$ and $x = 5$. f has a vertical asymptote at $x = 0$ and a hole at $x = 5$

b) g has no discontinuities

c) h has discontinuities: at $x = -6, -3, 0, 1$, and 4 . h has vertical asymptotes at $x = -6, 0$, and 4 , and holes at $x = -3$, and 1

5.) a) ∞ b) $-\infty$ c) $\frac{3}{2}$ d) $\frac{3}{2}$ e) 0 f) 0 g) $-\frac{1}{2}$ h) $-\infty$

6.) a) $\gamma = 55^\circ$, $a = 5.149654$ $c = 9.98146542$

b) $\alpha = 14.5322^\circ$ $\gamma = 123.4678^\circ$ $c = 19.946979$

c) $\beta_1 = 49.926866^\circ$ $\gamma_1 = 90.073134^\circ$ $c_1 = 32.670174$

$\beta_2 = 130.073134^\circ$ $\gamma_2 = 9.926866^\circ$ $c_2 = 5.632048$ d) no solution

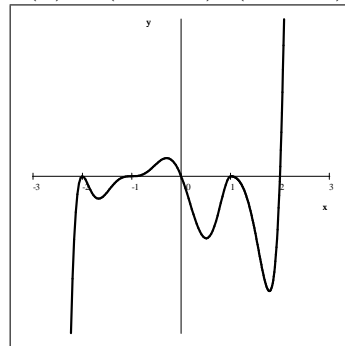
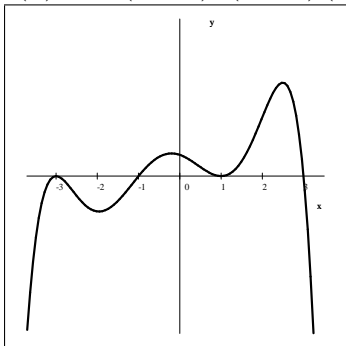
7.) $2, -1, 0, 1$ 8.) $\frac{2\sqrt{13}}{13}$ 9.) $2 - \sqrt{3}$

10.) a) 4 b) $\frac{1}{5}(\log_3 32 - 1)$ c) $3 \log_{20} 10$ d) $\log_2 6$ e) ± 3 f) $2k\pi, \pm \frac{2\pi}{3} + 2k\pi$ where $k \in \mathbb{Z}$

g) $\frac{\pi}{2} + k\pi$ where $k \in \mathbb{Z}$ h) $k\pi, \pm \frac{\pi}{3} + k\pi$ where $k \in \mathbb{Z}$ i) 3 11.) $\frac{15}{4}$ 12.) $\sqrt{3}$

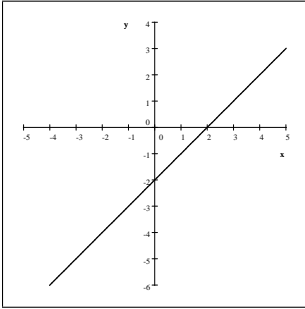
13.) a) $A = nr^2 \sin\left(\frac{180^\circ}{n}\right) \cos\left(\frac{180^\circ}{n}\right)$ b) $A = \frac{1}{2}nr^2 \sin\left(\frac{360^\circ}{n}\right)$ 14.) $y = -2x + 9$ and $y = 15$

15.) a) $f(x) = -(x+3)^2(x+1)(x-1)^2(x-3)$ b) $f(x) = (-2-x)^2(-1-x)^3x(1-x)^2(2-x)$

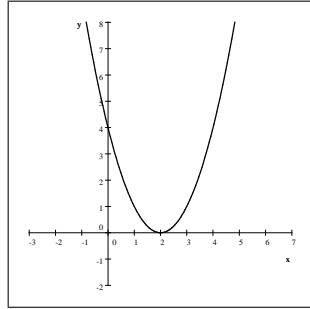


16.) $f(x) = -(x+4)(x+2)^2x(x-3)(x-5)^2$ (there are other correct answers possible!)

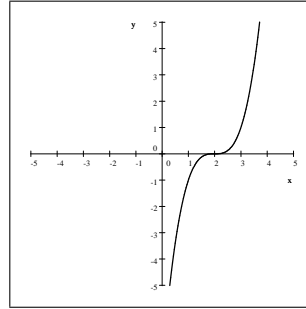
17.) a) $f(x) = x - 2$



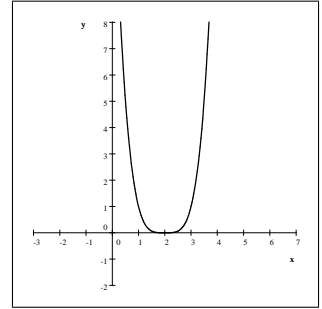
b) $g(x) = (x - 2)^2$



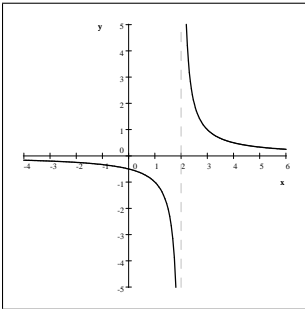
c) $h(x) = (x - 2)^3$



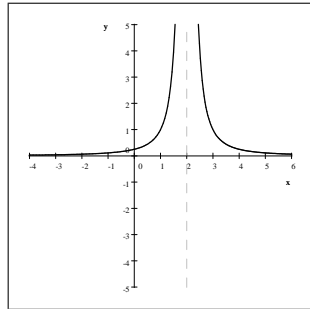
d) $k(x) = (x - 2)^4$



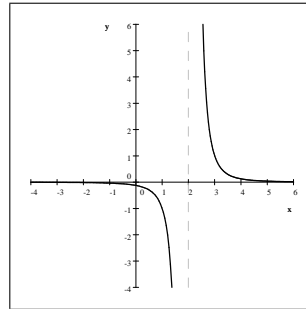
e) $f(x) = \frac{1}{x - 2}$



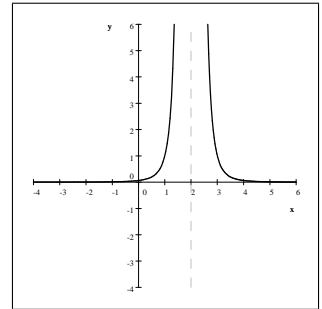
f) $g(x) = \frac{1}{(x - 2)^2}$



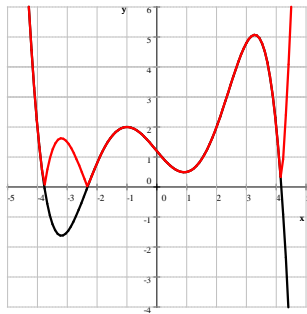
g) $h(x) = \frac{1}{(x - 2)^3}$



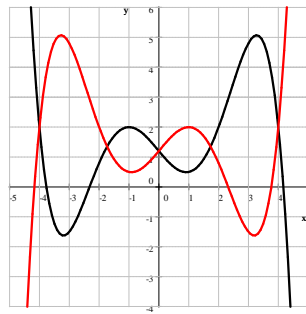
h) $k(x) = \frac{1}{(x - 2)^4}$



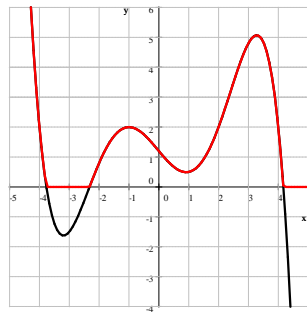
18.) a) $g(x) = |f(x)|$



b) $h(x) = f(-x)$



c) $p(x) = \frac{f(x) + |f(x)|}{2}$



d) $q(x) = f(x) \cdot \frac{x - 2}{x - 2}$

