

Review Problems

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. Perform the following divisions between the polynomials given.

a) $x^4 + 5x^3 - x^2 + 10$ by $x + 2$ d) $x^4 - 3x^3 + 5x^2 - 6x + 1$ by $x^2 - 2$
b) $5x^4 - 7x^3 + 3x^2 - 9x + 8$ by $x - 1$ e) $x^4 + x^2 - 3$ by $x^2 - x + 2$
c) $x^4 - 6x^3 + 3x^2 - 2x$ by $x - 5$ f) $x^6 - 1$ by $x^2 - 1$

3. Find $\tan \beta$ if we know that $\tan \alpha = \frac{1}{2}$ and $\tan(\alpha + \beta) = \frac{13}{11}$.

4. Compute the exact value of each of the following.

a) $\sin x$ if $\cos 2x = -\frac{2}{3}$ b) $\cos x$ if $\cos 2x = \frac{4}{5}$ c) $\cos x$ if $\sin 2x = \frac{5}{13}$ d) $\sin 2x$ if $\tan x = 2$

5. Let l be the line $y = -\frac{4}{3}x$. Find an equation for the line that bisects the angle formed between l and the positive part of the x -axis.

6. We place \$3000 into a bank account with an annual compound interest rate of 7%, compounded annually. How long does it take for the money to double in the account?

7. 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?

8. 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?

9. Find an equation for the tangent line drawn to the circle $(x-4)^2 + (y+5)^2 = 25$ at the point $(7, -1)$.

10. Consider the geometric sequence determined by $a = 240$ and $r = \frac{1}{2}$.

- a) Compute a_{15} . b) Compute s_{15} .

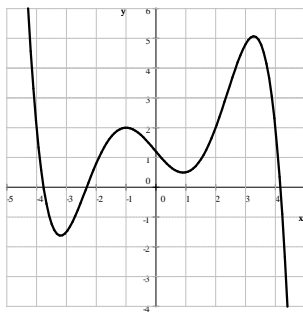
11. Solve each of the following equations.

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

12. Graph each of the following functions.

a) $f(x) = \sqrt{x}$ b) $f(x) = \log_2 x$ c) $f(x) = \frac{1}{x}$ d) $f(x) = \log_{1/2} x$
 e) $f(x) = 2^x$ f) $f(x) = \left(\frac{1}{2}\right)^x$ g) $f(x) = \frac{1}{x^2}$ h) $f(x) = -|x|$

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

14. Find the domain of each of the following functions.

a) $f(x) = \ln(\sin^2 x)$ b) $f(x) = \frac{1}{\sin x - \cos x}$ c) $f(x) = \log_5(\sin x + \cos x)^2$

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

16. Compute each of the following limits.

a) $\lim_{x \rightarrow -\infty} \left(-\frac{2}{3}x^9\right)$ c) $\lim_{x \rightarrow -\infty} (0.2x^{12})$ e) $\lim_{x \rightarrow -\infty} (0.95^x)$ g) $\lim_{x \rightarrow -\infty} \left(\frac{8}{3x^6}\right)$ i) $\lim_{x \rightarrow -\infty} (\log_3 x)$
 b) $\lim_{x \rightarrow \infty} \left(-\frac{2}{3}x^9\right)$ d) $\lim_{x \rightarrow \infty} (0.2x^{12})$ f) $\lim_{x \rightarrow \infty} (0.95^x)$ h) $\lim_{x \rightarrow \infty} \left(\frac{8}{3x^6}\right)$ j) $\lim_{x \rightarrow \infty} (\log_3 x)$

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) $x^3 + 3x^2 - 7x + 14$ R -18 b) $5x^3 - 2x^2 + x - 8$ c) $x^3 - x^2 - 2x - 12$ R -60

d) $x^2 - 3x + 7$ R $-12x + 15$ e) $x^2 + x$ R $-2x - 3$ f) $x^4 + x^2 + 1$

3. $\frac{3}{7}$

4. a) $\pm \frac{\sqrt{30}}{6}$ b) $\pm \frac{3\sqrt{10}}{10}$ c) $\pm \frac{\sqrt{26}}{26}, \pm \frac{5\sqrt{26}}{26}$ d) $\frac{4}{5}$

5. $y = 2x$ or $y = -\frac{1}{2}x$

6. $t = \frac{\ln 2}{\ln 1.07} \approx 10.2447683510587$ - a little bit more than 10 years

7. a) 63.11% b) 6.99 hours c) 20 hours

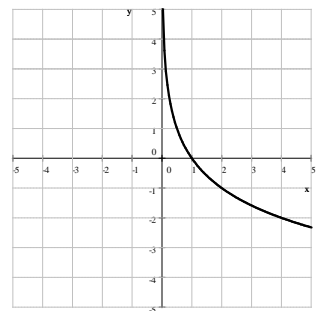
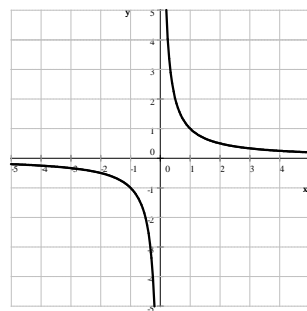
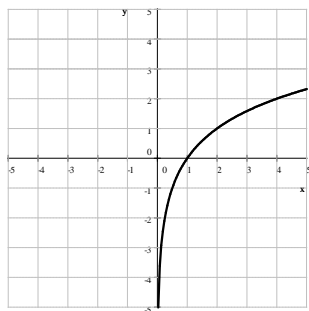
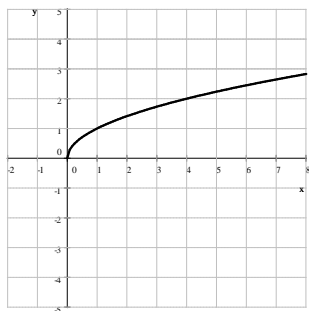
8. 7.604 hours

9. $y = -\frac{3}{4}x + \frac{17}{4}$

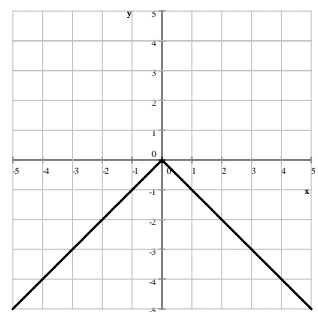
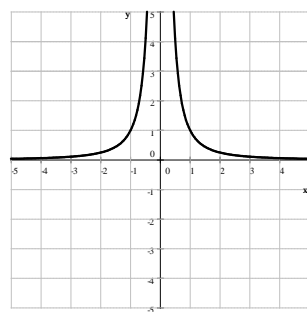
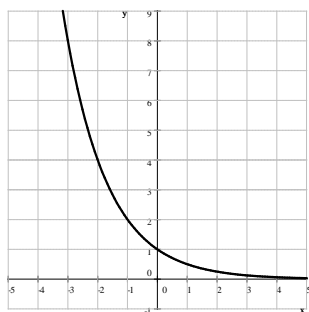
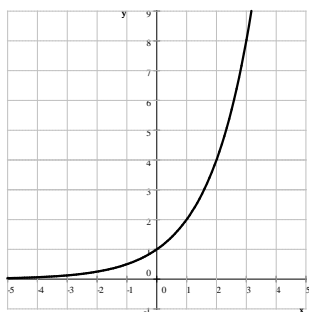
10. a) $(240) \left(\frac{1}{2}\right)^{14} \approx 0.0146484375$ b) $(240) \frac{1 - \left(\frac{1}{2}\right)^{20}}{\frac{1}{2}} \approx 480.000$

11. 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

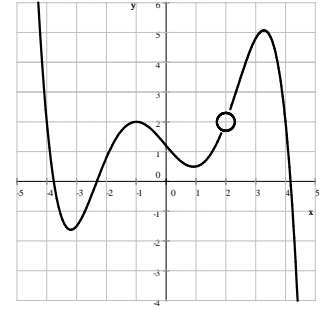
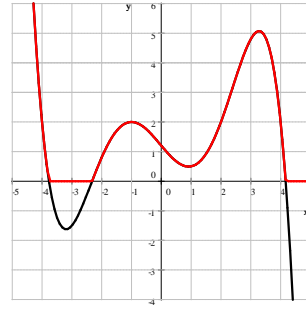
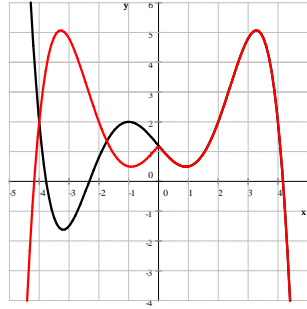
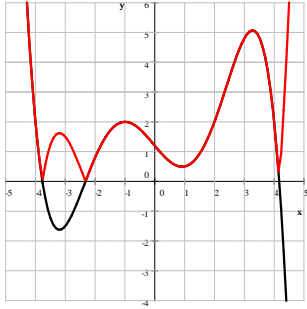
12. a) $f(x) = \sqrt{x}$ b) $f(x) = \log_2 x$ c) $f(x) = \frac{1}{x}$ d) $f(x) = \log_{1/2} x$



e) $f(x) = 2^x$ f) $f(x) = \left(\frac{1}{2}\right)^x$ g) $f(x) = \frac{1}{x^2}$ h) $f(x) = -|x|$



13. a) $g(x) = |f(x)|$ b) $h(x) = f(|x|)$ c) $p(x) = \frac{f(x) + |f(x)|}{2}$ d) $q(x) = f(x) \cdot \frac{x-2}{x-2}$



14. a) $x \neq k\pi$ $k \in \mathbb{Z}$ b) $x \neq \frac{\pi}{4} + k\pi$ $k \in \mathbb{Z}$ c) $x \neq -\frac{\pi}{4} + k\pi$ $k \in \mathbb{Z}$

15. $y = -2x + 9$ and $y = 15$

16. a) ∞ b) $-\infty$ c) ∞ d) ∞ e) ∞ f) 0 g) 0 h) 0 i) undefined j) ∞