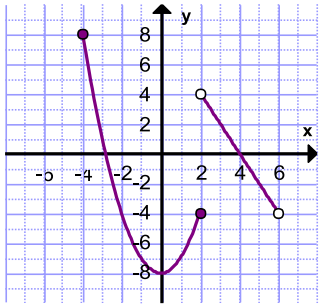
Answers:

1. a. 

b. $[-4,6)$ c. $[-8,8]$ d. $f(2) = -4$

e. $(0,2)$ f. $x = 2$ and $x = -2$

2. Increasing: $(-4.3,0) \cup (2.8,\infty)$ Local Min: @ -10.9 and -3.4 Local Max: @ 0 Absolute Min: @ -10.9 Absolute Max: None Minimum possible degree of f : 4 Leading coefficient is positive

3. a. $x = -2 \pm i$ b. $x = 5$ (note: $x = 8$ is an extraneous root) c. $x = 5$, $x = -5$, $x = 5i$, $x = -5i$

d. $x = 2$, $x = -1$ e. $x = \pm 2\sqrt{2}$ f. $x = -3/2$

4. $f(x) = -2(x-4)(x+1)(x-1)(x+2i)(x-2i)$

5. $f(x) = -7(x+1)(x)^3(x-4)^2$

6. a. $f(x) = \frac{1}{2}(x+2)(x-1)(x-2)$ b. $f(x) = 1(x)^2(x-2)^3$

7. a. Total number of zeros: 4 Real zeros: 2 each with multiplicity 1 Nonreal zeros: 2 each with multiplicity 1
b. Total number of zeros: 5 Real zeros: 1 with multiplicity 1; 2 each with multiplicity 2 Nonreal zeros: None

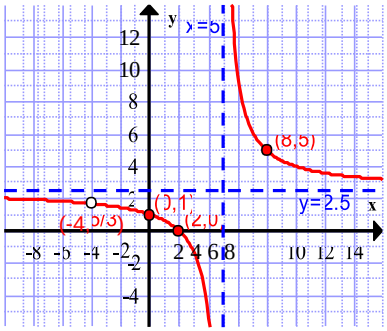
8. Coordinates of hole: (-4, 5/3)

Vertical asymptote: $x = 5$

Horizontal asymptote: $y = 5/2$

Vertical intercept: (0, 1)

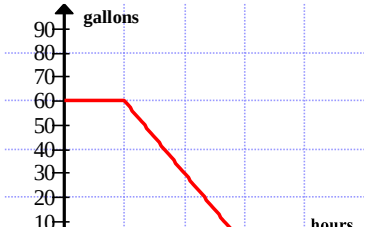
Horizontal intercept: (2,0)



9. a. Horizontal Units: time in hours Vertical Units: mg/liter b. In one hour the drug concentration is 2.5 mg/l.
c. From 1 to 3 hours, the drug is decreasing at a rate of 1 mg/l each hour.

10. a. nonlinear b. $\frac{f(x+h)-f(x)}{h} = 10x + 5h$ c. The difference quotient is 30. From 1 to 4 seconds the car's speed average speed is about 30 meters per second. d. Draw a line connecting the points (1,12) and (5, 132) and label the slope = 30.

11. $g(x) = \begin{cases} 60 & \text{for } 0 \le x \le 1 \\ -30x + 90 & \text{for } 1 < x \le 3 \end{cases}$



12. a. $g(x)=\frac{1}{2}(8x^2-10x-6)=$ $\boxed{4x^2-5x-3}$ b. $g(x)=8(x-2)^2-10(x-2)-6+6=$ $\boxed{8(x-2)^2-10(x-2)}$ $\boxed{8x^2+10x-6}$

c. $g(x)=-1(8x^2-10x-6)=$ $\boxed{-8x^2+10x+6}$ d. $g(x)=8(-x)^2-10(-x)-6=$

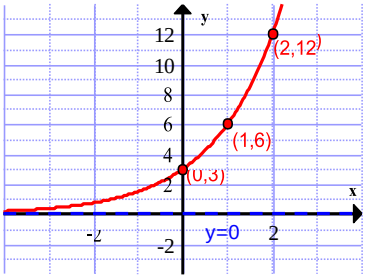
13. a. 3 b. -1 c. -4 d. Undefined e. 3 f. -1 g. 0 h. Not Defined

14. a. (16,8) b. (20,12) c. (16,-48) d. (4,12)

15. a. 0 b. -1 c. -2 d. -1.5 e. Not Defined f. 2 g. -1.5 h. Not Defined

16. a. $f(x)=338(1.017)^x$ b. Population in 2020 will be about 473,500. c. Reach 400,000 in about 2010.

17. a. $f(x)=2(1.044)^x$ b. $f(x)=3.575(1.038)^x$



18. a. $(-\infty,\infty)$ b. $(0,\infty)$ c. $y=0$ d. (0,3) e.

19. a. \$5905.43 b. \$5907.92 c. 42.3 years to double

20. a. $f(x)=50(0.917)^x$ b. About 8.8 grams are left after 20 days. c. Takes about 37 days to decay to 2 grams.

21. a. 2 b. 1/2 c. 12 d. 1.7604

22. a. $3\ln a+4\ln b-8\ln c$ b. $\frac{1}{2}\log(x^2+1)-\frac{1}{3}\log(x^2+2)$

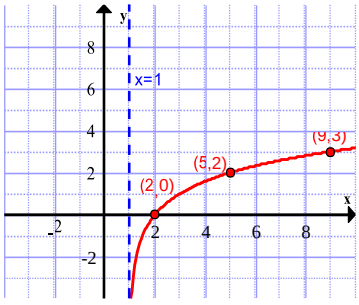
23. a. $\log_2\frac{x^3}{y^5}$ b. $\ln\left((x+4)(x-1)^2\right)$

24. a. $x=-2/3$ b. $x\approx 1.585$ c. $x=7$ (note: $x=0$ is an extraneous root) d. $x\approx 0.1353$ e. $x=2$ f. $x=1/5$

25. a. [-.5, 5] b. $(0,\ 8/3)$

26. a. $(-\sqrt{2},\sqrt{2})$ b. $(-\infty,6)\cup[1,2)$

27. a. $(1,\infty)$ b. $(-\infty,\infty)$ c. $x=0$ d. (2,0) e.



28. a. $2x^{-\frac{1}{2}}(x+1)(x+2)(x-2)$

29. $(x+1)^2+(y-1)^2=10$

30. y=-3x-15

31. y=-2/3x+4

32. $t \approx 19.9$; It will take about 19.9 minutes to cool to 56 degrees Fahrenheit.

33. a. The carrying capacity is about 600 womp rats.
    b. $t \approx 11.26$; It will take about 11 years for the population to reach 550 womp rats.