**Honors Algebra 2** Name Key

**2nd Semester Exam Review**

| | |
|---|---|
| 1. Divide. $(x^3+5x^2-7x+2)\div(x+2)$<br>$-2\,\rfloor\; 1 \quad 5 \quad -7 \quad 2$<br>$\downarrow \quad -2 \quad -6 \quad 26$<br>$1 \quad 3 \quad -13 \quad 28$<br>$x^2+3x-13+\frac{28}{(x+2)}$ | 2. Find the quotient. $(2x^3+17x^2+23x-42)\div(2x+7)$<br>$2x+7 \overline{)\,2x^3+17x^2+23x-42}$ with quotient $x^2+5x-6$<br>$-2x^3+^-7x^2$<br>$10x^2+23x$<br>$-10x^2+^-35x$<br>$-12x-42$<br>$+12x+42$<br>$0$<br>$x^2+5x-6$ |
| 3. Subtract. $(9z^2+3z-7)-(4z^2-8z+9)$<br>$9z^2+3z-7-4z^2+8z-9$<br>$5z^2+11z-16$ | 4. Multiply. $(3x+8)(4x-2)(5x+7)$<br>$(12x^2-6x+32x-16)(5x+7)$<br>$(12x^2+26x-16)(5x+7)$<br>$60x^3+130x^2-80x+84x^2+182x-112$<br>$60x^3+214x^2+102x-112$ |
| 5. Simplify. $\left(\frac{(x^2y^{-3})}{(xy^4)^{-1}}\right)^5 \rightarrow \left(\frac{x^2y^{-3}}{x^{-1}y^{-4}}\right)^5$<br>$\rightarrow (x^3y^1)^5$<br>$\rightarrow x^{15}y^5$ | 6. Simplify. $(-2a^5b^3)^6\bullet(-4a^5b^6)^{-3}$<br>$64a^{30}b^{18}\cdot\frac{1}{(-4a^5b^6)^3}$<br>$\frac{64a^{30}b^{18}}{-64a^{15}b^{18}}$<br>$-a^{15}$ |
| 7. Solve. $3x^5+15x=18x^3$<br>$3x^5-18x^3+15x=0$<br>$3x(x^4-6x^2+5)=0$<br>$3x(x^2-1)(x^2-5)=0$<br>$3x(x+1)(x-1)(x^2-5)=0$<br>$3x=0 \quad x+1=0 \quad x-1=0 \quad x^2-5=0$<br>$x=0 \quad x=-1 \quad x=1 \quad x=\pm\sqrt{5}$ | 8. Write the answer in scientific notation. $(3.2\times10^5)(7\times10^{-2})$<br>$(3.2\times7)(10^5\times10^{-2})$<br>$22.4\times10^3$<br>$2.24\times10^1\times10^3$<br>$2.24\times10^4$ |

9. Factor completely. $2z^4 - 1250$

$2(z^4 - 625)$

$2(z^2 + 25)(z^2 - 25)$

$2(z^2 + 25)(z - 5)(z + 5)$

10. Factor completely. $d^4 - 7d^2 + 10$

$(d^2 - 5)(d^2 - 2)$

11. Factor completely.

$x^5 - 25x^3 + 64x^2 - 1600$

$(x^5 + -25x^3) + (64x^2 - 1600)$

$x^3(x^2 - 25) + 64(x^2 - 25)$

$(x^2 - 25)(x^3 + 64)$

$(x+5)(x-5)(x+4)(x^2 - 4x + 16)$

12. Find all the factors, zeros, and x-intercepts.

$f(x) = x^3 - 6x^2 + 4x - 24$

$f(x) = (x^3 - 6x^2) + (4x - 24)$

$= x^2(x - 6) + 4(x - 6)$

$= (x - 6)(x^2 + 4)$

Factors: $(x-6)(x^2+4)$

Zeros: $x = 6$ $x = \pm 2i$

xint: $(6, 0)$

$x^2 + 4 = 0$

$x^2 = -4$

$x = \pm 2i$

13. Find all the factors, zeros, and x-intercepts.

$f(x) = x^4 + 2x^3 - 5x^2 - 12x - 4$

* does not factor: use calc + table

| | | | | | |
|---|---|---|---|---|---|
| -2 | 1 | 2 | -5 | -12 | -4 |
| | ↓ | -2 | 0 | 10 | 4 |
| | 1 | 0 | -5 | -2 | 0 |
| -2 | ↓ | -2 | 4 | 2 | |
| | 1 | -2 | -1 | 0 | |

$x^2 - 2x - 1$

$\frac{2 \pm \sqrt{4 - 4(1)(-1)}}{2(1)}$

$\frac{2 \pm \sqrt{8}}{2} \rightarrow \frac{2 \pm 2\sqrt{2}}{2} \rightarrow 1 \pm \sqrt{2}$

Factors:
$(x+2)^2(x^2 - 2x - 1)$

Zeros:
$x = -2$ OR $x = 1 \pm \sqrt{2}$

xint $(-2, 0)$
$(1+\sqrt{2}, 0)$
$(1-\sqrt{2}, 0)$

14. Find all the factors, zeros, and x-intercepts.

$f(x) = x^4 + 5x^3 + 4x^2 + 20x$

$f(x) = (x^4 + 5x^3) + (4x^2 + 20x)$

$= x^3(x + 5) + 4x(x + 5)$

$= (x + 5)(x^3 + 4x)$

$= x(x + 5)(x^2 + 4)$

Factors: $x(x+5)(x^2+4)$

Zeros: $x = 0$ $x = -5$ $x = \pm 2i$

xint: $(0, 0)$ $(-5, 0)$

15. Find the value of $k$ so the remainder is 7.

$(x^3 + kx^2 - 9) \div (x + 2)$

| | | | | |
|---|---|---|---|---|
| -2 | 1 | K | 0 | -9 |
| | ↓ | -2 | -2K+4 | 4K-8 |
| | 1 | K-2 | -2K+4 | 4K-17 |

$4K - 17 = 7$

$4K = 24$

$K = 6$

$K = 6$

16. Find the value of $k$ so the remainder is 1.

$(x^2 + 3x + 3) \div (x - k)$

| | | | |
|---|---|---|---|
| K | 1 | 3 | 3 |
| | ↓ | K | $K^2 + 3K$ |
| | 1 | K+3 | $K^2 + 3K + 3$ |

$K^2 + 3K + 3 = 1$

$K^2 + 3K + 2 = 0$

$(K+2)(K+1) = 0$

$K = -2$ $K = -1$

17. Degree: Even / Odd

Leading Coefficient: Positive / Negative

How many Relative Maxima: 2

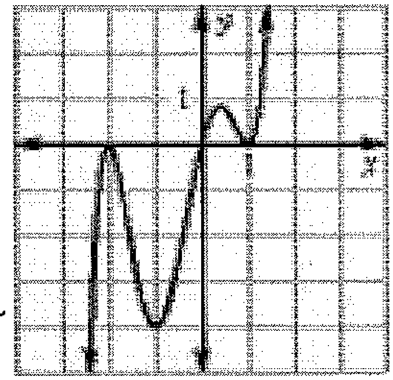
How Many Relative Minima: 2

Least Degree of the polynomial: 5

Real Zeros: $-2$ DR , 0, 1 (DR)

Known factors based on the real zeros: $(x+2)^2\ (x)\ (x-1)^2$

Domain and Range: Dom: $\mathbb{R}$ Range: $\mathbb{R}$



18. **Write a polynomial function of least degree with a leading coefficient of 1 given the following zeros:** $-4,\ 7-\sqrt{5}$, $7+\sqrt{5}$

Sum: $7-\sqrt{5}+7+\sqrt{5} = \frac{14}{1} = \frac{-b}{a}$

prod: $(7-\sqrt{5})(7+\sqrt{5}) = \frac{44}{1} = \frac{c}{a}$

$(x^2-14x+44)(x+4)$

$f(x) = x^3-10x^2-12x+176$

19. **Write a polynomial function of least degree with a leading coefficient of 1 given the following zeros:** 0 (*double*), $3+2i$, $3-2i$

Sum: $3+2i+3-2i = \frac{6}{1} = \frac{-b}{a}$

prod: $(3+2i)(3-2i) = \frac{13}{1} = \frac{c}{a}$

$(x^2-6x+13)(x)(x)$

$f(x) = x^4-6x^3+13x^2$

20. **Given the functions, perform the indicated operations.**

$f(x) = x+8 \qquad g(x) = x^2-9 \qquad h(x) = 2x+1$

a) $[h \circ g](3)$

$g(3) = (3)^2-9$
$= 9-9$
$= 0$

$h(0) = 2(0)+1$
$= 0+1$
$= 1$

b) $[g \circ f \circ h](x)$

$h(x) = 2x+1$

$f(2x+1) = 2x+1+8$
$= 2x+9$

$g(2x+9) = (2x+9)^2-9$
$= 4x^2+36x+81-9$
$= 4x^2+36x+72$

c) $f(x)-g(x)$

$(x+8)-(x^2-9)$

$x+8-x^2+9$

$-x^2+x+17$

21. **Simplify.** $\sqrt[3]{\dfrac{343a^{12}b^9}{27c^2}}$

$\dfrac{7a^4b^3}{3\sqrt[3]{c^2}} \cdot \dfrac{\sqrt[3]{c}}{\sqrt[3]{c}}$

$\dfrac{7a^4b^3\sqrt[3]{c}}{3c}$

22. **Simplify.** $\dfrac{x^{-\frac{1}{3}}+3x^{\frac{1}{3}}}{\sqrt[3]{x^{-2}}} \longrightarrow \dfrac{x^{-\frac{1}{3}}+3x^{\frac{1}{3}}}{x^{-2/3}}$

$(x^{-\frac{1}{3}}+3x^{\frac{1}{3}}) \cdot x^{2/3}$

$x^{\frac{1}{3}}+3x^{3/3}$

$\sqrt[3]{x}+3x$

23. **Simplify.** $\sqrt[5]{\sqrt[4]{x^{40}}}$

$\sqrt[5]{x^{40/4}}$

$\sqrt[5]{x^{10}}$

$x^{10/5}$

$x^2$

24. **Simplify.** $\sqrt{49x^2+56x+16}$

$\sqrt{(7x+4)(7x+4)}$

$\sqrt{(7x+4)^2}$

$7x+4$

25. **Solve.** $\sqrt{2x+1}=x+5$

$\sqrt{2x+1}^{\,2} = (x+5)^2$

$2x+1 = x^2+10x+25$

$0 = x^2+8x+24$

$\dfrac{-8 \pm \sqrt{64-4(1)(24)}}{2(1)}$

$\dfrac{-8 \pm \sqrt{-32}}{2}$

$\dfrac{-8 \pm 4i\sqrt{2}}{2} \rightarrow -4 \pm 2i\sqrt{2}$

No Real Sol.

26. **Solve.** $\frac{1}{3}(2x+4)^{\frac{2}{3}}=\frac{16}{3}$

$(2x+4)^{2/3} = 16$

$\sqrt[3]{(2x+4)^2} = 16$

$\sqrt[3]{2x+4} = \pm 4$

$2x+4 = \pm 64$

$2x+4=64$    $2x+4=-64$

$2x=60$    $2x=-68$

$x=30$ ✓    $x=-34$ ✓

27. **Solve.** $\sqrt{5x+6}+3=\sqrt{3x+3}+4$

$\sqrt{5x+6} = \sqrt{3x+3}+1$

$\sqrt{5x+6}^{\,2} = (\sqrt{3x+3}+1)(\sqrt{3x+3}+1)$

$5x+6 = 3x+3+2\sqrt{3x+3}+1$

$2x+2 = 2\sqrt{3x+3}$

$x+1 = \sqrt{3x+3}$

$x^2+2x+1 = 3x+3$

$x^2-x-2=0$

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

$x=2$ ✓    $x=-1$ ✓

28. **Solve.** $\sqrt{k+25}-\sqrt{k}>\sqrt{5}$

$\sqrt{k+25} > \sqrt{k}+\sqrt{5}$

$k+25 > k+2\sqrt{5k}+5$

$20 > 2\sqrt{5k}$

$10 > \sqrt{5k}$

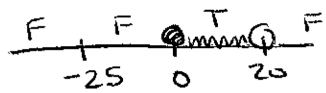
$100 > 5k$

$20 > k$*

$k+25 \ge 0$

*$k \ge -25$

*$k \ge 0$




$0 \le x < 20$

or $[0, 20)$

29. **Solve.** $\sqrt{x+10}+\sqrt{x-6}<8$

$x+10 \ge 0$

$x \ge -10$*

$x-6 \ge 0$

$x \ge 6$*

$\sqrt{x+10} < 8-\sqrt{x-6}$

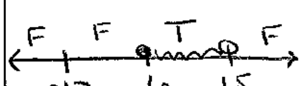
$x+10 < 64-16\sqrt{x-6}+x-6$

$-48 < -16\sqrt{x-6}$

$3 > \sqrt{x-6}$

$9 > x-6$

$15 > x$*




$6 \le x < 15$

or $[6, 15)$

30. **Find the inverse of** $f(x)=16(x+6)^2-9$

$x = 16(y+6)^2-9$

$x+9 = 16(y+6)^2$

$\dfrac{x+9}{16} = (y+6)^2$

$\pm\sqrt{\dfrac{x+9}{4}} = y+6$

$-6 \pm \sqrt{\dfrac{x+9}{4}} = y$

$f^{-1}(x) = \pm\sqrt{\dfrac{x+9}{4}} - 6$

**31.** Find the inverse of $g(x)=\frac{2x^3-6}{9}$

$x=\frac{2y^3-6}{9}$

$9x=2y^3-6$

$9x+6=2y^3$

$\frac{9x+6}{2}=y^3$

$\sqrt[3]{\frac{9x+6}{2}}=y$

$\frac{\sqrt[3]{9x+6}}{\sqrt[3]{2}}\cdot\frac{\sqrt[3]{2\cdot2}}{\sqrt[3]{2\cdot2}}$

$\frac{\sqrt[3]{36x+24}}{2}$

$g^{-1}(x)=\frac{\sqrt[3]{36x+24}}{2}$

**32.** Verify algebraically that the following functions are inverses of each other.

$f(x)=3x+9 \qquad g(x)=\frac{1}{3}x-3$

$f(g(x))=3(\frac{1}{3}x-3)+9$

$=x-9+9$

$*=x$

$g(f(x))=\frac{1}{3}(3x+9)-3$

$=x+3-3$

$*=x$

Both $=x$ proves they are inverses!

**33.** Use $\log_9 7\approx 0.8856$ and $\log_9 4\approx 0.6309$ to evaluate the following:

a) $\log_9\frac{7}{4}$

$\log_9 7-\log_9 4$

$.8856-.6309$

$0.2547$

b) $\log_9 28$

$\log_9(7\cdot4)$

$\log_9 7+\log_9 4$

$.8856+.6309$

$1.5165$

c) $\log_9 324$

$\log_9(9\cdot9\cdot4)$

$\log_9 9+\log_9 9+\log_9 4$

$1+1+.6309$

$2.6309$

d) $\log_9\frac{112}{36}$

$\log_9 28/9$

$\log_9 28-\log_9 9$

$1.5165-1$

$0.5165$

**34.** Evaluate. $7^{\log_7(x-5)}$

$\log_7 ?=\log_7(x-5)$

$x-5$

**35.** Evaluate. $\log_7\sqrt[9]{7}$

$\log_7 7^{1/9}$

$\frac{1}{9}$

**36.** Evaluate. $\log_8(\log_5 5)$

$\log_8(1)$

$8^?=1$

$0$

**37.** Evaluate. $\log_2\frac{1}{64}$

$2^?=\frac{1}{64}$

$2^?=\frac{1}{2^6}$

$2^?=2^{-6}$

$-6$

**38.** Solve. $\log_6(7x-11)=\log_6(2x+9)$

$7x-11=2x+9$

$5x-11=9$

$5x=20$

$x=4$ ✓

**39.** Solve. $\log_7(x^2+6x)=\log_7(x-4)$

$x^2+6x=x-4$

$x^2+5x+4=0$

$(x+4)(x+1)=0$

$\cancel{x=-4}\quad x=-1$

No Solution

**40.** **Solve.** $\log_{16}(9x+5)-\log_{16}(x^2-1)=\frac{1}{2}$

$\log_{16}\frac{9x+5}{x^2-1}=\frac{1}{2}$

$16^{1/2}=\frac{9x+5}{x^2-1}$ $\quad x=-3/4$ ✗

$4=\frac{9x+5}{x^2-1}$ $\quad x=3$ ✓

$4x^2-4=9x+5$

$4x^2-9x-9=0$

$(4x+3)(x-3)=0$

**41.** **Solve.** $5^{3x}=4^{x+3}$

$\log 5^{3x}=\log 4^{(x+3)}$

$3x\log 5=(x+3)\log 4$

$3x\log 5=x\log 4+3\log 4$

$3x\log 5-x\log 4=3\log 4$

$x(3\log 5-\log 4)=3\log 4$

$x=\frac{3\log 4}{(3\log 5-\log 4)}$ $\quad x\approx 1.2083$

**42.** **Solve.** $\log_4(5-x)^3=6$

$4^6=(5-x)^3$

$4096=(5-x)^3$

$16=5-x$

$11=-x$

$x=-11$

**43.** **Solve.** $\log_9 x=\frac{1}{3}\log_9 64+\frac{1}{4}\log_9 81$

$\log_9 x=\log_9 64^{1/3}+\log_9 81^{1/4}$

$\log_9 x=\log_9(4\cdot 3)$

$x=4\cdot 3$

$x=12$

**44.** **Solve.** $\log_4 16-\log_4\frac{1}{4}+\log_4 5=\log_4 3x$

$\log_4(16\div\frac{1}{4}\cdot 5)=\log_4 3x$

$\log_4(320)=\log_4 3x$

$320=3x$

$x=\frac{320}{3}$ or $x=106\frac{2}{3}$

**45.** **Solve.**
$\log_6(3m+7)-\log_6(m+4)=2\log_6 6-3\log_6 3$

$\log_6\frac{(3m+7)}{(m+4)}=\log_6(6^2\div 3^3)$

$\frac{3m+7}{m+4}=\frac{36}{27}$

$\frac{3m+7}{m+4}=\frac{4}{3}$

$9m+21=4m+16$

$5m=-5$ $\quad m=-1$

**46.** **Graph** $y=\log_{\frac{1}{2}}(x+3)$.

* inv: $y=(\frac{1}{2})^x-3$

Domain: $(-3,\infty)$

Range: $(-\infty,\infty)$

x-intercept(s): $(-2,0)$

y-intercept(s): $(0,-1.5850)$

Horizontal Asymptote(s): None

Vertical Asymptote(s): $x=-3$

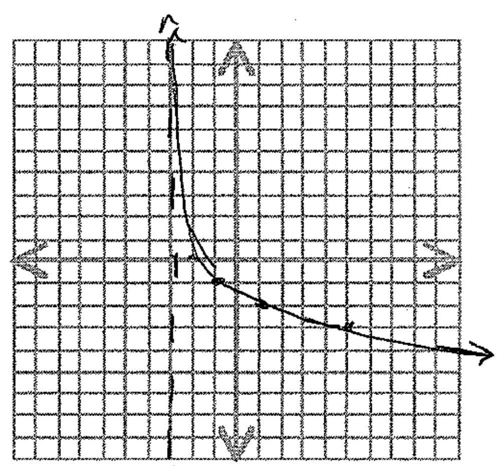
End Behavior: $x\to\infty$ $y\to-\infty$
$x\to -3$ $y\to\infty$

y int: $y=\log_{\frac{1}{2}}(0+3)$

$y=\log_{\frac{1}{2}}3$

$y=\frac{\log 3}{\log 1/2}$

| x | y |
|---|---|
| 13 | -4 |
| 5 | -3 |
| 1 | -2 |
| -1 | -1 |
| -2 | 0 |
| -2.5 | 1 |



**47.** Rewrite the following function in $f(x)=ab^x$ form using properties of exponents. State if it is a growth or decay exponential function.

$$f(x)=\frac{1}{4}\bullet 2^{-x-1}$$

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

$\frac{1}{4}\left(\frac{1}{2}\right)^{x+1}$

$\frac{1}{4}\left(\frac{1}{2}\right)^{x}\left(\frac{1}{2}\right)^{1}$

$\frac{1}{8}\left(\frac{1}{2}\right)^{x}$

$f(x)=\frac{1}{8}\left(\frac{1}{2}\right)^x$
Exp. Decay

**48.** Rewrite the following function in $f(x)=ab^x$ form using properties of exponents. State if it is a growth or decay exponential function.

$$f(x)=2(27)^{\frac{x}{3}}$$

$f(x)=2\,(27^{1/3})^x$

$=2\,(3)^x$

$f(x)=2(3)^x$
Exp. Growth

**49.** Write an exponential function whose graph passes through the points: $(-3,\ 243)$ $\left(0,\ \frac{1}{3}\right)$

$y=ab^x$

$243=ab^{-3}$

$\frac{1}{3}=ab^0$

$\frac{1}{3}=a$

$243=\frac{1}{3}b^{-3}$

$729=b^{-3}$

$\frac{729}{1}=\frac{1}{b^3}$

$729b^3=1$

$b^3=1/729$

$b=1/9$

$y=\frac{1}{3}\left(\frac{1}{9}\right)^x$

**50.** Write an exponential function whose graph passes through the points: $(1,\ 1.25)$ $(3,\ 31.25)$

$1.25=ab^1 \rightarrow a=\frac{1.25}{b}$

$31.25=ab^3$

$31.25=\frac{1.25}{b}\cdot b^3$

$31.25=1.25b^2$

$25=b^2$

$\pm 5=b$

$5=b$

$a=\frac{1.25}{5}$

$a=1/4$

$y=\frac{1}{4}(5)^x$

**51.** Given the parent function $f(x)=\left(\frac{1}{6}\right)^x$, write the equation for the function $g(x)$ after each of the following transformations.

a) Vertically stretch by a factor of 4, shifted down 3 units, and reflected over the y-axis.

$g(x)=4\left(\frac{1}{6}\right)^{-x}-3$

b) Horizontally compress by a factor of $\frac{1}{5}$ and reflected over the x-axis.

$g(x)=-\left(\frac{1}{6}\right)^{5x}$

c) Horizontally stretched by a factor of 8 and shifted down 3 units.

$g(x)=\left(\frac{1}{6}\right)^{x/8}-3$

**52.** Graph $f(x)=2^{(x-1)}-3$

* shift rt 1
* shift down 3

Parent $y=2^x$

| x | y |
|---|---|
| -3 | 1/8 |
| -2 | 1/4 |
| -1 | 1/2 |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |
| 3 | 8 |

$0=2^{(x-1)}-3$

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

$\log 3=(x-1)\log 2$

$\frac{\log 3}{\log 2}+1=x$

Domain: $(-\infty,\ \infty)$

Range: $(-3,\ \infty)$

x-intercept(s): $(2.5850,\ 0)$

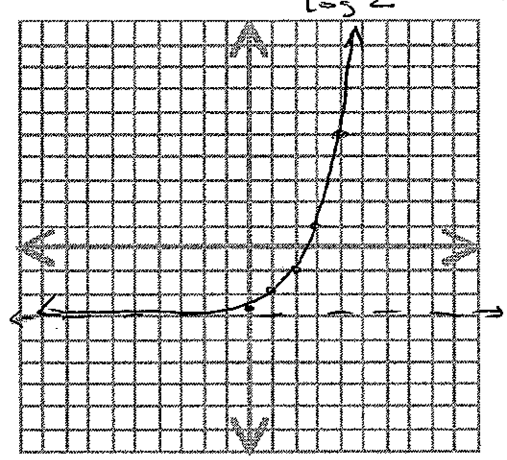
y-intercept(s): $(0,\ -5/2)$

Horizontal Asymptote(s): $y=-3$

Vertical Asymptote(s): none

End Behavior: $x\rightarrow-\infty \quad y\rightarrow-3$
$x\rightarrow\infty \quad y\rightarrow\infty$

| x | y |
|---|---|
| -2 | $-2\frac{7}{8}$ |
| -1 | $-2\frac{3}{4}$ |
| 0 | $-2\frac{1}{2}$ |
| 1 | -2 |
| 2 | -1 |
| 3 | 1 |
| 4 | 5 |



53. **Graph** $f(x)=\left(\frac{1}{3}\right)^{(x+2)}-4$

Parent $y=\left(\frac{1}{3}\right)^x$

| x | y |
|---|---|
| -2 | 9 |
| -1 | 3 |
| 0 | 1 |
| 1 | 1/3 |
| 2 | 1/9 |
| 3 | 1/27 |

Domain: $(-\infty, \infty)$

Range: $(-4, \infty)$

x-intercept(s): $(-3.2619, 0)$

y-intercept(s): $(0, -3\,8/9)$

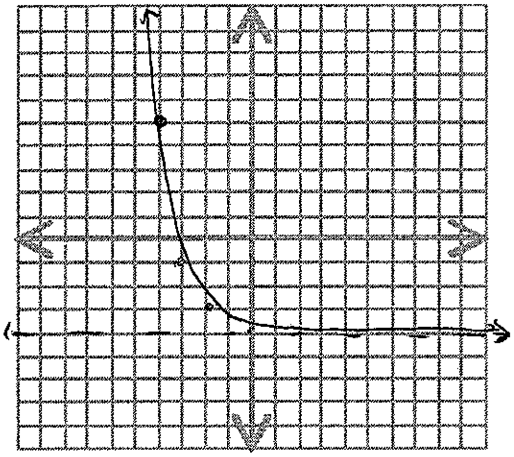
Horizontal Asymptote(s): $y=-4$

Vertical Asymptote(s): none

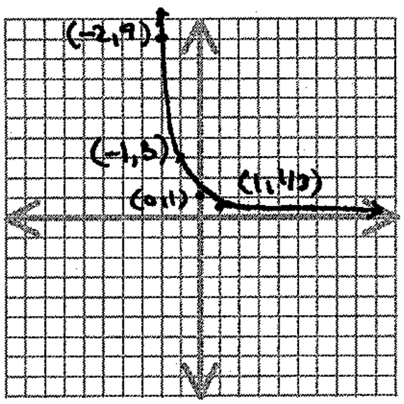
End Behavior: $x \to \infty \quad y \to -4$

$x \to -\infty \quad y \to \infty$

| x | y |
|---|---|
| -4 | 5 |
| -3 | -1 |
| -2 | -3 |
| -1 | $-3\,2/3$ |
| 0 | $-3\,8/9$ |
| 1 | $-3\,26/27$ |



54. $f(x)=\left(\frac{1}{3}\right)^x$




**Transformation: Reflect the graph over the x-axis.**

a. How did the coordinates change?

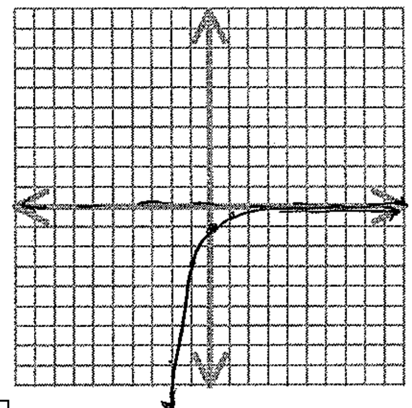
negate all y values (multiply y's by -1)

b. What equation would result from the transformation?

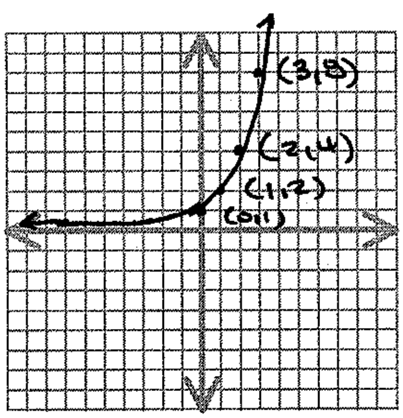
$g(x) = -\left(\frac{1}{3}\right)^x$

c. Complete the table.

| x | -2 | -1 | 0 | 1 |
|---|---|---|---|---|
| y | -9 | -3 | -1 | -1/3 |



55. $f(x)=2^x$




**Transformation: Horizontally stretch by a factor of 3.**

a. How did the coordinates change?

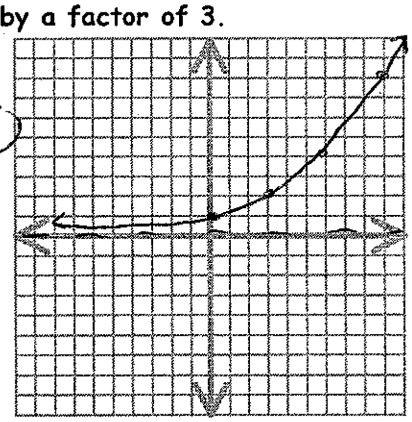
multiply all x's by 3

b. What equation would result from the transformation?

$g(x) = 2^{x/3}$

c. Complete the table.

| x | 0 | 3 | 6 | 9 |
|---|---|---|---|---|
| y | 1 | 2 | 4 | 8 |



56. **In 1992, 1,219 monk parakeets were observed in the United States. For the next 11 years, about 12% more parakeets were observed each year. Use the formula $A=P(1\pm r)^n$.**

a. Write an exponential function showing the growth of the parakeets. $y = 1219\,(1.12)^x$

b. In 1998, about how many parakeets were observed in the US? $y = 1219(1.12)^6$

$y = 2406.09 \quad y \approx 2406$

c. In what year were 1,712 parakeets observed? $1712 = 1219\,(1.12)^x$

$x \approx 2.99$ yrs End of 1994 almost 1995

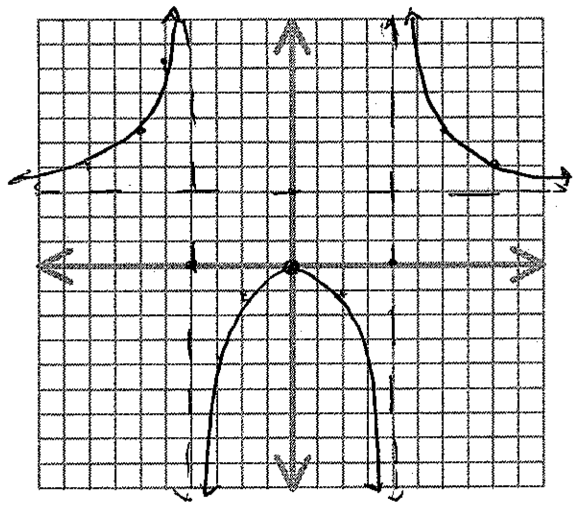
57. **Graph the function. State the domain, range, x-intercept(s), y-intercept(s), vertical asymptote(s), and horizontal asymptote(s).**

$$f(x) = \frac{3x^2}{x^2 - 16}$$

VA: $x^2 - 16 = 0$

$x^2 = 16$

$x = \pm 4$



VA: $x = 4 \quad x = -4$

HA: $y = 3$

x-intercept(s): $(0,0)$

y-intercept(s): $(0,0)$

Domain: $\mathbb{R}\ x \neq \pm 4$

Range: $(-\infty, 0] \cup (3, \infty)$

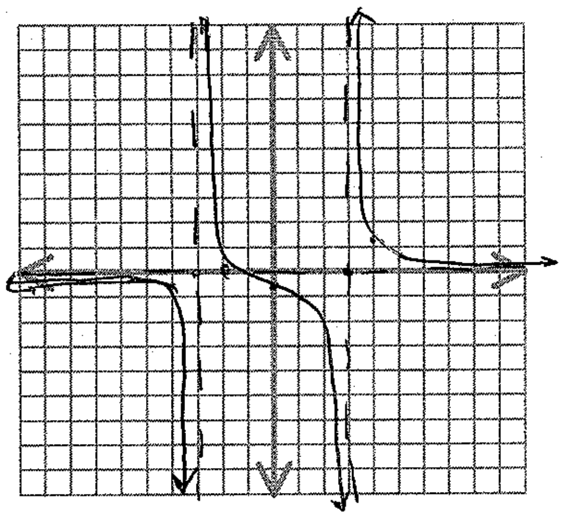
58. **Graph the function. State the domain, range, x-intercept(s), y-intercept(s), vertical asymptote(s), and horizontal asymptote(s).**

$$f(x) = \frac{2x + 4}{x^2 - 9}$$

VA = $x^2 - 9 = 0$

$x^2 = 9$

$x = \pm 3$



VA: $x = -3 \quad x = 3$

HA: $y = 0$

x-intercept(s): $(-2, 0)$

y-intercept(s): $(0, -4/9)$

Domain: $\mathbb{R}\ x \neq \pm 3$

Range: $\mathbb{R}$

59. **Simplify.** $\dfrac{x+5}{x^2 + 10x + 25} \bullet \dfrac{2x+10}{3x+15}$

$$\frac{(x+\cancel{5})}{(x+5)(x\cancel{+5})} \cdot \frac{2\cancel{(x+5)}}{3\cancel{(x+5)}}$$

$$\frac{2}{3(x+5)}$$

60. **Simplify.** $\dfrac{3x^2 - 3}{2x^2 + 8x + 6} \div \dfrac{5x^2 - 10x + 5}{4x + 12}$

$$\frac{3(x^2-1)}{2(x^2+4x+3)} \cdot \frac{4(x+3)}{5(x^2-2x+1)}$$

$$\frac{3\cancel{(x+1)}\cancel{(x-1)}}{\cancel{2}\cancel{(x+1)}\cancel{(x+3)}} \cdot \frac{\overset{2}{\cancel{4}}\cancel{(x+3)}}{5\cancel{(x-1)}(x-1)}$$

$$\frac{6}{5(x-1)}$$

**61.** **Simplify.** $\dfrac{\dfrac{3}{x-2}-\dfrac{6}{x^2-4}}{\dfrac{3}{x+2}+\dfrac{1}{x-2}}$

$$\frac{\dfrac{3(x+2)}{(x-2)(x+2)}-\dfrac{6}{(x+2)(x-2)}}{\dfrac{3(x-2)}{(x+2)(x-2)}+\dfrac{1(x+2)}{(x-2)(x+2)}}$$

$$\frac{3x+6-6}{(x+2)(x-2)}\cdot\frac{(x+2)(x-2)}{3x-6+x+2}$$

$$\frac{3x}{\cancel{(x+2)}\cancel{(x-2)}}\cdot\frac{\cancel{(x+2)}\cancel{(x-2)}}{4x-4}$$

$$\frac{3x}{4(x-1)}$$

**62.** **Simplify.** $\dfrac{16x^2}{4x-8}\div\dfrac{x}{x^2-4}\bullet\dfrac{8}{x+2}$

$$\frac{16x^2}{4(x-2)}\cdot\frac{(x+2)(x-2)}{x}\cdot\frac{8}{(x+2)}$$

$$32x$$

**63.** **Simplify.** $\dfrac{x+1}{x^2+4x+4}-\dfrac{6}{x^2-4}$

$(x+2)(x+2)\quad (x+2)(x-2)$

$$\frac{(x+1)(x-2)}{(x+2)(x+2)(x-2)}+\frac{-6(x+2)}{(x+2)(x-2)(x+2)}$$

$$\frac{x^2-x-2-6x-12}{(x+2)(x+2)(x-2)}$$

$$\frac{x^2-7x-14}{(x+2)(x+2)(x-2)}$$

**64.** **Simplify.** $\dfrac{\dfrac{r+6}{r}-\dfrac{1}{r+2}}{\dfrac{r^2+4r+3}{r^2+r}}$

$$\frac{(r+6)(r+2)}{r(r+2)}-\frac{1r}{(r+2)r}$$

$$\frac{r^2+8r+12-r}{r(r+2)}$$

$$\frac{r^2+7r+12}{r(r+2)}$$

$$\frac{r^2+7r+12}{r(r+2)}\cdot\frac{r(r+1)}{(r+3)(r+1)}$$

$$\frac{(r+4)\cancel{(r+3)}}{\cancel{r}(r+2)}\cdot\frac{\cancel{r}\cancel{(r+1)}}{\cancel{(r+3)}\cancel{(r+1)}}$$

$$\frac{r+4}{r+2}$$

**65.** **Solve.** $\dfrac{18}{x^2-3x}-\dfrac{6}{x-3}=\dfrac{5}{x}$ LCD: $x(x-3)$ Ex Val: 0, 3

$$\frac{18}{x(x-3)}-\frac{6x}{(x-3)x}=\frac{5(x-3)}{x(x-3)}$$

$18-6x=5x-15$

$18=11x-15$

$33=11x$

$3=x$ extraneous

No Solution

**66.** **Solve.** $\dfrac{x+2}{2x+1}=\dfrac{x}{3}+\dfrac{3}{4x+2}$ LCD: $2(3)(2x+1)$ Ex Val: $-1/2$

$$\frac{(x+2)\cdot 6}{(2x+1)\cdot 6}=\frac{x(2)(2x+1)}{3(2)(2x+1)}+\frac{3\cdot 3}{2(2x+1)\cdot 3}$$

$6x+12=4x^2+2x+9$

$0=4x^2-4x-3$

$0=(2x+1)(2x-3)$

$x=-1/2$ extraneous $\quad x=3/2$

$x=3/2$

**67.** **Solve.** $\dfrac{1}{4x-3}+\dfrac{5}{x}=27$ LCD: $(4x-3)x$ Ex Val: $3/4$, 0

$$\frac{1x}{(4x-3)x}+\frac{5(4x-3)}{x(4x-3)}=\frac{27(x)(4x-3)}{(x)(4x-3)}$$

$x+20x-15=108x^2-81x$

$0=108x^2-102x+15$

$0=36x^2-34x+5$

$$\frac{34\pm\sqrt{(-34)^2-4(36)(5)}}{2(36)}\qquad\frac{34\pm\sqrt{436}}{72}\qquad\frac{34\pm2\sqrt{109}}{72}$$

$$x=\frac{17\pm\sqrt{109}}{36}$$

**68.** **Solve.** $\dfrac{3}{x-4}-\dfrac{1}{x+4}\le\dfrac{40}{x^2-16}$ LCD: $(x+4)(x-4)$

$$\frac{3(x+4)}{(x-4)(x+4)}+\frac{-1(x-4)}{(x+4)(x-4)}\le\frac{40}{(x+4)(x-4)}$$

$3x+12-x+4\le 40$

$2x+16\le 40$

$2x\le 24$

$x\le 12$

T F T F

−4 4 12

$x<-4$ or $4<x\le 12$

OR

$(-\infty,-4)\cup(4,12]$