

Quarter 3 Mid-Semester Exam Review

Name Key

Non Calculator

(#1-19) Simplify the following expressions. Leave no negative exponents.

1) $\frac{(9x^5y)^2}{(3x^0y)}$

$$\frac{81x^{10}y^2}{3y}$$

$$\boxed{27x^{10}y}$$

2) $\frac{y^{-8}}{y^8}$

$$\boxed{\frac{1}{y^{16}}}$$

3) $\frac{3^{-2}wk^{-3}}{(9w)^{-1}}$

$$\frac{3^{-2}wk^{-3}}{9^{-1}w^{-1}}$$

$$\frac{9^1w^1}{3^2k^3} = \frac{9w^2}{9k^3} = \boxed{\frac{w^2}{k^3}}$$

4) $(-9m^5)^2 \cdot m^{-3}$

$$81m^{10} \cdot m^{-3}$$

$$\boxed{81m^7}$$

5) $\left(\frac{3k^0}{k^{-6}}\right)^2$

$$(3k^6)^2$$

$$\boxed{9k^{12}}$$

6) $4d^4g^{-3} \cdot 2^{-2}$

$$\frac{4d^4}{g^3} \cdot \frac{1}{2^2}$$

$$\frac{4d^4}{4g^3} = \boxed{\frac{d^4}{g^3}}$$

7) $\frac{6x^2}{xy} \cdot x^3$

$$\frac{6x}{y} \cdot x^3$$

$$\boxed{\frac{6x^4}{y}}$$

8) $(13x^{-2}b^{-21})^0$

$$\boxed{1}$$

9) $3^{-2}\left(\frac{8}{11^0}\right)$

$$\frac{1}{3^2}\left(\frac{8}{1}\right)$$

$$\boxed{\frac{8}{9}}$$

10) $2^{-4} \cdot 2^1$

$$2^{-3}$$

$$\boxed{\frac{1}{8}}$$

11) $\frac{8d^4}{3c^{10}d^{-5}}$

$$\boxed{\frac{8d^9}{3c^{10}}}$$

12) $\frac{16x^7y^{-4}}{(2x^{-1}y^{-6})^2}$

$$\frac{16x^7y^{-4}}{4x^{-2}y^{-12}}$$

$$\frac{16x^7x^2y^{12}}{4y^4} = \boxed{4x^9y^8}$$

13) $\left(\frac{y^7}{3x}\right)^2 \cdot \frac{6y}{x^{-2}y^3}$

$$\frac{y^{14}}{9x^2} \cdot \frac{6x^2}{y^2}$$

$$\boxed{\frac{2y^{12}}{3}}$$

14) $\frac{16}{4x^{-3}}$

$$\boxed{4x^3}$$

15) $\frac{(4r^7t^2r^{-1})^6}{r^3t^{-7}}$

$$\frac{(4r^6t^2)^6}{r^3t^{-7}}$$

$$\frac{4^6r^{36}t^{12}}{r^3t^{-7}}$$

$$\boxed{4^6r^{33}t^{19}}$$

16) $\frac{1}{12t^{-4}}$

$$\boxed{\frac{t^4}{12}}$$

17) $(-2a^2b^3c)^3(-2a^4c^6)^2$

$$(-8a^6b^9c^3)(4a^8c^{12})$$

$$\boxed{-32a^{14}b^9c^{15}}$$

18) $3^{-2} \cdot 3^8 \cdot 3^{-15} \cdot 3^0$

$$3^{-9}$$

$$\boxed{\frac{1}{3^9}}$$

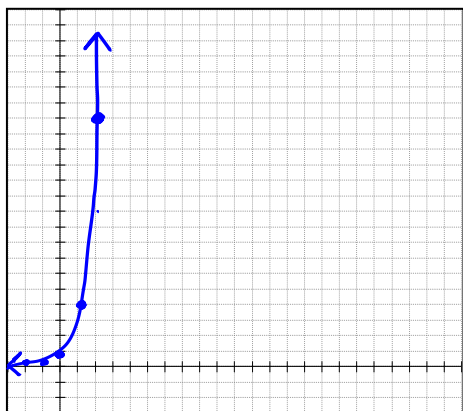
19) $(4^8)^2$

$$\boxed{4^{16}}$$

(#20-21) Graph the following exponential functions and identify the key features described below.

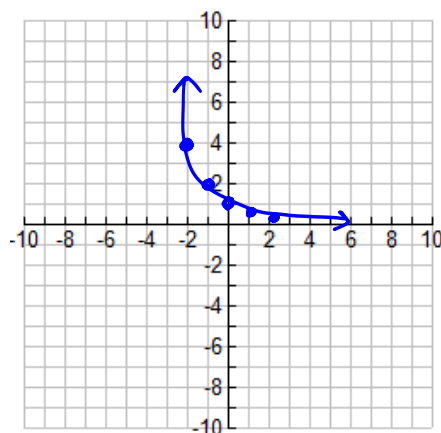
20) $y = 4^x$

x	-2	-1	0	1	2
y	$1/16$	$1/4$	1	4	16



21) $y = \left(\frac{1}{2}\right)^x$

x	-2	-1	0	1	2
y	4	2	1	$1/2$	$1/4$



(#22-27) Determine if the following exponential model is growth or decay.

22) $y = 16(1.20)^x$

growth

23) $y = 12(.80)^x$

decay

24) $y = \frac{1}{3} \cdot \left(\frac{7}{2}\right)^x$

growth

25) $y = 10\left(\frac{5}{4}\right)^{-x}$

$y = 10\left(\frac{4}{5}\right)^x$

decay

26) $y = 12\left(\frac{4}{5}\right)^x$

decay

27) $y = \left(\frac{2}{7}\right)^{-x}$

$y = \frac{7}{2}^x$

growth

(#28-31) Name the following polynomials by number of terms and degree

28) $x^2 + 2x$

quadratic
binomial

29) x^3

cubic
monomial

30) $x^4 + 2x + 1$

4th degree (quartic)
trinomial

31) 3

constant
monomial

(#32-34) Add, subtract or multiply the following polynomials

32) $(x^3 + 2x^2 + 5x + 1) + (3x^2 - 2x + 5)$

$$\underline{x^3} + \underline{2x^2} + \underline{5x} + \underline{1} + \underline{3x^2} - \underline{2x} + \underline{5}$$

$$\boxed{x^3 + 5x^2 + 3x + 6}$$

33) $(x^3 + 2x^2 + 5x + 1) - (3x^2 - 2x + 5)$

$$\underline{x^3} + \underline{2x^2} + \underline{5x} + \underline{1} - \underline{3x^2} + \underline{2x} - \underline{5}$$

$$\boxed{x^3 - x^2 + 7x - 4}$$

34) $(2x^2 + 5x + 1)(3x^2 - 2x + 5)$

$$\underline{6x^4} - \underline{4x^3} + \underline{10x^2} + \underline{15x^3} - \underline{10x^2} + \underline{25x} + \underline{3x^2} - \underline{2x} + \underline{5}$$

$$\boxed{6x^4 + 11x^3 + 3x^2 + 23x + 5}$$

(#35-38) Factor the following polynomials completely

35) $3x^2 - 6x$

$$3x(x - 2)$$

36) $x^2 + 8x + 12$

$$(x + 6)(x + 2)$$

37) $x^2 - 11x - 26$

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

38) $4x^2 - 49$

$$(2x + 7)(2x - 7)$$

(#39-41) Solve each equation by using the zero product property

39) $(x - 3)(x + 5) = 0$

$$\begin{array}{l} \downarrow \\ x - 3 = 0 \\ +3 \quad +3 \\ \hline \boxed{x = 3} \end{array}$$

$$\begin{array}{l} \downarrow \\ x + 5 = 0 \\ -5 \quad -5 \\ \hline \boxed{x = -5} \end{array}$$

40) $2x^2 - 5x - 12 = 0$

$$\begin{array}{l} (2x + 3)(x - 4) = 0 \\ \downarrow \qquad \downarrow \\ 2x + 3 = 0 \quad x - 4 = 0 \\ 2x = -3 \quad \boxed{x = 4} \\ \boxed{x = -3/2} \end{array}$$

41) $(x - 4)(x + 2) = -5$

$$\begin{array}{l} x^2 + 2x - 4x - 8 = -5 \\ x^2 - 2x - 8 = -5 \\ x^2 - 2x - 3 = 0 \\ (x - 3)(x + 1) = 0 \\ \downarrow \qquad \downarrow \\ x - 3 = 0 \quad x + 1 = 0 \\ \boxed{x = 3} \quad \boxed{x = -1} \end{array}$$

(#42-43) Use completing the square to put the following quadratics in Vertex form

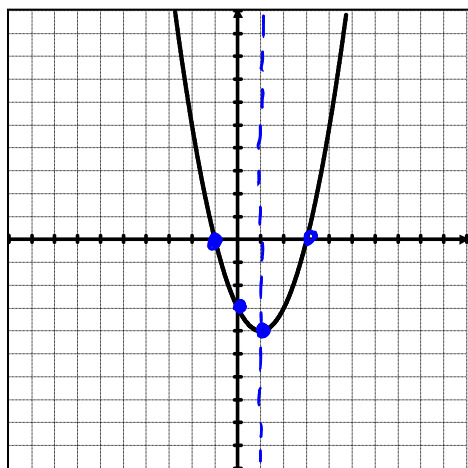
42) $y = (x^2 + 6x) + 3$

$$\begin{array}{l} y = (x^2 + 6x + 9) + 3 - 9 \\ \boxed{y = (x + 3)^2 - 6} \end{array}$$

43) $y = (x^2 + 8x) + 3$

$$\begin{array}{l} y = (x^2 + 8x + 16) + 3 - 16 \\ \boxed{y = (x + 4)^2 - 13} \end{array}$$

44) Given the graph find the zeros, the axis of symmetry, the vertex, and the y-intercept



Zeros: $(-1, 0)$ & $(3, 0)$

A.O.S.: $x = 1$

Vertex: $(1, -4)$

y-intercept: $(0, -3)$

(#45-46) Find the vertex of each of the quadratic functions

45) $y = 2(x-3)^2 + 5$

$\rightarrow 3 \uparrow 5$

$(3, 5)$

46) $y = 2x^2 - 4x + 1$

$$x = \frac{-b}{2a} = \frac{-(-4)}{2(2)} = 1$$

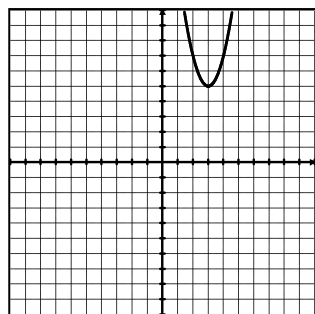
$(1, -1)$

$$y = 2(1)^2 - 4(1) + 1$$

$$y = 2(1) - 4 + 1$$

$$y = -1$$

47) How many real zeros (solutions) do the following quadratics have?



Number of real Zeros:

no x-intercepts...
no real zeros

$$y = x^2 - 6x + 9$$

$$b^2 - 4ac$$

$$(-6)^2 - 4(1)(9)$$

$$36 - 36$$

$$0$$

Number of real Zeros:

1 real zero
(vertex)

$$y = -(x-3)^2 - 5$$

$$0 = -(x-3)^2 - 5$$

$$+5 \quad +5$$

$$+5 = -(x-3)^2$$

$$\sqrt{-5} = \sqrt{(x-3)^2}$$

Number of real Zeros:

No real zero

48) Find the axis of symmetry and the y-intercept of $y = x^2 + 6x - 2$

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

$$y = (-3)^2 + 6(-3) - 2$$

$$y = 9 - 18 - 2$$

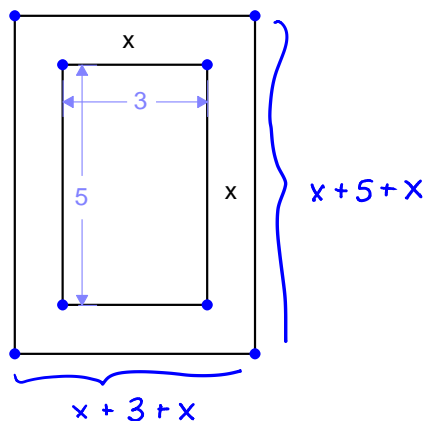
$$y = -11$$

$x = -3$
 $(-3, -11)$

← vertex

$(0, -2)$
y-int

49) Write a polynomial in standard form to represent the area of the entire figure shown (assume Rectangles). There is a path of x feet around a 3ft by 5ft garden.



$$A = b \cdot h$$

$$A = (x + 3)(2x + 5)$$

$$A = 4x^2 + 10x + 6x + 15$$

$$A = 4x^2 + 16x + 15$$

(#50-53) Identify the transformations that are performed on the following quadratic functions:

50) $y = (x - 3)^2 + 2$

$\rightarrow 3$
 $\uparrow 2$

51) $y = 7(x + 4)^2$

v. stretch
baf 7
 $\leftarrow 4$

52) $y = -(x)^2 - 9$

reflect
over x-axis
 $\downarrow 9$

53) $y = \frac{1}{3}(-x)^2$

v. shrink
baf 3
reflect over
y-axis

54) Given the graph to the right, identify the following:

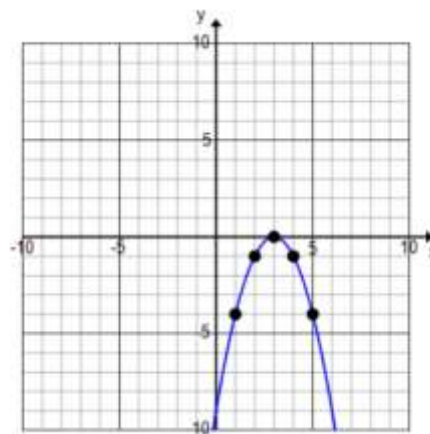
Domain: $(-\infty, \infty)$

Range: $y \leq 0$ or $(-\infty, 0]$

End Behavior: $x \rightarrow -\infty, y \rightarrow -\infty$
 $x \rightarrow \infty, y \rightarrow -\infty$

Increasing interval: $(-\infty, 3]$

Decreasing interval: $[3, \infty)$



Calculator OK

$$y = a(1 \pm r)^t$$

55) You deposit \$500 in a bank account that pays 8% annual interest compounded yearly. What is the account balance after 6 years?

$$y = 500(1 + .08)^6$$

$\$793.44$

56) You buy a computer for \$3,000 that depreciates at a rate of 20% per year. Find the value of the computer after 5 years.

$$y = 3000(1 - .2)^5$$

$$\boxed{\$983.04}$$

57) The concentration of aspirin in a person's bloodstream decreases by 20% each hour after taking a dose. If a person took 250 mg 6 hours ago, how much aspirin is left in his bloodstream now?

$$y = 250(.8)^6$$

$$\boxed{65.536 \text{ mg}}$$

58) Use the quadratic formula to solve the following quadratic equation: $x^2 - 4x + 2 = 0$

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

$$\boxed{\begin{array}{l} x \approx 3.41 \\ x \approx 0.59 \end{array}}$$

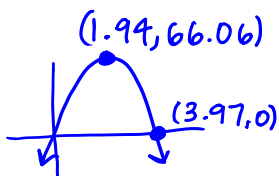
$$x = \frac{4 \pm \sqrt{16 - 8}}{2} = \frac{4 \pm \sqrt{8}}{2}$$

59) The following equation represents the height of a football (in feet) as a function of how long it has been since it was thrown (in seconds): $h(t) = -16t^2 + 62t + 6$

a) How high off the ground was it thrown from?

$$\boxed{6 \text{ ft}}$$

b) What was the highest it went?



$$\boxed{66.06 \text{ ft after } 1.94 \text{ sec}}$$

c) How long did it stay in the air?

$$\boxed{3.97 \text{ seconds}}$$