#15 & 16 are from lesson 2-4.

Pre Calculus
Chapter 2A Review

Name: Cofield
Block: ______

No Calculator. Show all applicable work for full credit.

For questions 1-2, determine whether the function is a polynomial function or not. If so, state the degree and leading coefficient. If not, explain why not. ***(2-1)***

1. $f(x)=12x^2+x-9$ polynomial
deg: 2 LC: 12

2. $f(x)=3x^{-1}+1$ not a polynomial
because exponent -1 is not a whole #.

3. Find the equation of a line in general form where $f(-2)=5$ and $f(1)=-7$. ***(2-1)***

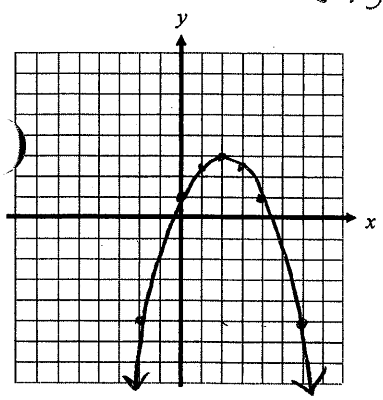
$(-2,5)$ $(1,-7)$
$\frac{-7-5}{1+2}=\frac{-12}{3}=-4$

$y-5=-4(x+2)$
$y-5=-4x-8$

$\boxed{4x+y+3=0}$

For questions 4-5, list the vertex, describe the transformation and draw a graph for each function. ***(2-1)***

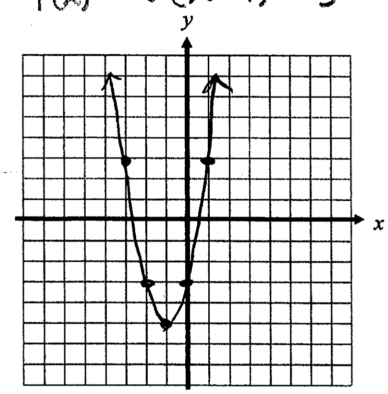
4. $f(x)=-\frac{1}{2}(x-2)^2+3$
vertex: $(2,3)$
v. shrink $\frac{1}{2}$, refl. over x-axis
move rt 2, up 3
$(x,y)\rightarrow(x+2,-\frac{1}{2}y+3)$



	v. $-\frac{1}{2}$
$(-2,4)$	$(-2,-2)$
$(-1,1)$	$(-1,-\frac{1}{2})$
$(0,0)$	$(0,0)$
$(1,1)$	$(1,-\frac{1}{2})$
$(2,4)$	$(2,-2)$

count from vertex

5. $f(x)=2x^2+4x-3$
* compl. sq. or use $\frac{-b}{2a}$
$f(x)=2(x^2+2x+1)-3-2$
$f(x)=2(x+1)^2-5$
vertex: $(-1,-5)$
vert. stretch 2
left 1, down 5
$(x,y)\rightarrow(x-1,2y-5)$



	v. 2
$(-2,4)$	$(-2,8)$
$(-1,1)$	$(-1,2)$
$(0,0)$	$(0,0)$
$(1,1)$	$(1,2)$
$(2,4)$	$(2,8)$

count from vertex

6. Write an equation for the quadratic function with vertex $(-3,4)$ and containing the point $(-5,-8)$. Leave your answer in vertex form. ***(2-1)***

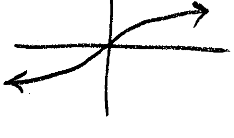
* Must have $y=$

$y=a(x+3)^2+4$
$-8=a(-5+3)^2+4$
$-8=4a+4$
$-12=4a$ $a=-3$

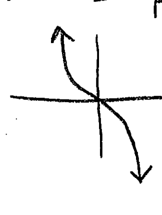
* $\boxed{y=-3(x+3)^2+4}$

For questions 7-9, if the function is a power function list the constant of variation and the power. Then, ***sketch*** *a graph for each function. If the function is not a power function, explain why not.* ***(2-2)***

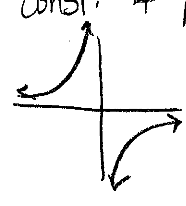
7. $f(x)=4x^{1/3}$ power
Const: 4 pwr: $\frac{1}{3}$



8. $f(x)=-2x^5$ power
const: -2 pwr: 5



9. $f(x)=-4x^{-3}$ power
Const: -4 pwr: -3



10. $f(x)=x^{1/4}+2x$
Not a power function b/c it has 2 terms. It's not of the form $y=kx^a$

For questions 11-12, use limit notation to describe the end behavior of each polynomial. **(2-3)**

11. $f(x) = -6x^5 + 3x^3 - 5x + 8$ $\quad \lim_{x \to \infty} f(x) = -\infty$

neg, odd

$\lim_{x \to -\infty} f(x) = \infty$

12. $f(x) = -3x^4 + 6x^3 - 10$ $\quad \lim_{x \to \infty} f(x) = -\infty$

neg, even

$\lim_{x \to -\infty} f(x) = -\infty$

For each function in questions 13-14, list the degree, state each zero and its multiplicity, and then graph each polynomial. Note a scale on the x-axis. **(2-3)** End Behavior

13. $f(x) = -3x(x+4)^2(x+1)^3$ $\quad \lim_{x \to \infty} f(x) = -\infty$

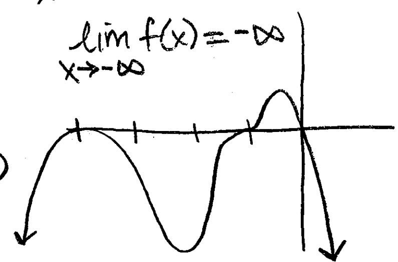
deg: 6

zeros: $x = 0$ (mult 1)

$x = -4$ (mult 2)

$x = -1$ (mult 3)

$\lim_{x \to -\infty} f(x) = -\infty$



14. $f(x) = 3x^3 - 18x^2 + 27x$

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

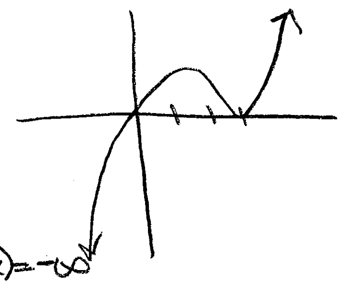
$= 3x(x^2 - 6x + 9)$

deg: 3

zeros: $x = 0$ (mult 1)

$x = 3$ (mult 2)

$\lim_{x \to \infty} f(x) = \infty \quad \lim_{x \to -\infty} f(x) = -\infty$



15. Find all zeros for the function $f(x) = 4x^4 - 4x^3 - 11x^2 + 6x + 9$ given that -1 is a zero with multiplicity 2.

(2-4)

$$\begin{array}{r|rrrrr} -1 & 4 & -4 & -11 & 6 & 9 \\ & & -4 & 8 & 3 & -9 \\ \hline -1 & 4 & -8 & -3 & 9 & 0 \\ & & -4 & 12 & -9 & \\ \hline & 4 & -12 & 9 & 0 & \end{array}$$

$4x^2 - 12x + 9 = 0$

$4x^2 - 12x + 9 = 0$

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

$\boxed{x = 3/2 \text{ (mult 2)} \quad x = -1 \text{ (mult 2)}}$

16. Find the equation for a polynomial function with leading coefficient 2 and zeros $\frac{1}{3}, -1$ and 4. Express your answer in factored form and standard form. (2-4)

$\boxed{y = \frac{2}{3}(3x-1)(x+1)(x-4)}$

or

$\boxed{y = 2(x - \frac{1}{3})(x+1)(x-4)}$

$y = (3x-1)(x+1)(x-4)$

$= (3x-1)(x^2 - 3x - 4)$

$= 3x^3 - 9x^2 - 12x - x^2 + 3x + 4$

$= 3x^3 - 10x^2 - 9x + 4$

Need lead. coef 2 but ours is 3. Mult by 2/3

$y = \frac{2}{3}(3x^3 - 10x^2 - 9x + 4)$

$\boxed{y = 2x^3 - \frac{20}{3}x^2 - 6x + \frac{8}{3}}$

*Be sure to read directions on the test for which form!

Divide using long division. Write a summary statement in polynomial form. **(2-4)**

17. $\dfrac{4x^3 - 8x^2 + 3x + 4}{2x + 1}$

$$\begin{array}{r} 2x^2 - 5x + 4 \\ 2x+1 \overline{) 4x^3 - 8x^2 + 3x + 4} \\ -(4x^3 + 2x^2) \\ \hline -10x^2 + 3x \\ -(-10x^2 - 5x) \\ \hline 8x + 4 \\ -(8x + 4) \\ \hline 0 \end{array}$$

$\boxed{4x^3 - 8x^2 + 3x + 4 = (2x+1)(2x^2 - 5x + 4)}$

18. $(2x^3 - 5x + 9) \div (x + 3)$

$$\begin{array}{r} 2x^2 - 6x + 13 \\ x+3 \overline{) 2x^3 + 0x^2 - 5x + 9} \\ -(2x^3 + 6x^2) \\ \hline -6x^2 - 5x \\ -(-6x^2 - 18x) \\ \hline 13x + 9 \\ -(13x + 39) \\ \hline -30 \end{array}$$

$2x^3 - 5x + 9 = 2x^2 - 6x + 13 - \frac{30}{x+3}$

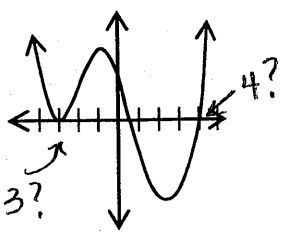
$\boxed{2x^3 - 5x + 9 = (x+3)(2x^2 - 6x + 13) - 30}$

19. Use the remainder theorem to find the remainder when $f(x)=x^3-3x+18$ is divided by $x+3$. Is $x+3$ a factor of $f(x)$? Explain. ***(2-4)***

$f(-3)=(-3)^3-3(-3)+18$
$=-27+9+18$
$=0$

The remainder is 0 so x+3 is a factor of f(x).

20. Use the graph below to help factor $f(x)=2x^4+3x^3-32x^2-57x+36$. The scale on the x-axis is 1 unit / tick. ***(2-4)***



$$\begin{array}{r|rrrrr} -3 & 2 & 3 & -32 & -57 & 36 \\ & & -6 & 9 & 69 & -36 \\ \hline 4 & 2 & -3 & -23 & 12 & 0 \\ & & 8 & 20 & -12 & \\ \hline & 2 & 5 & -3 & 0 & \end{array}$$

$\underbrace{\qquad}_{2x^2+5x-3}$

	x	$+3$
$2x$	$2x^2$	$+6x$
-1	$-1x$	-3

$-6 \mid 5$
$6, -1$

$\boxed{f(x)=(2x-1)(x+3)^2(x-4)}$

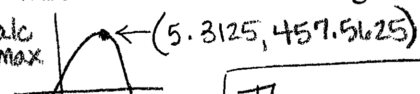
Calculator Allowed. Show all work for applicable credit.

21. Larry uses a slingshot to launch a rock straight up from a point 6 ft above level ground with an initial velocity of 170 ft/sec. Use the fact that $h(t)=-\frac{1}{2}gt^2+v_0t+h_0$. ***(2-1)*** $g=32\ ft/s^2$

a. Find an equation that models the height of the rock t seconds after it is launched.

$h(t)=-16t^2+170t+6$

b. What is the maximum height of the rock? When will it reach that height? Determine the answer algebraically and graphically. ⟶ Calc max



Alg

$\frac{-170}{2(-16)}=\frac{85}{16}=5.3125$

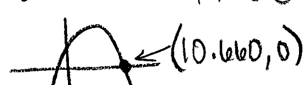
$h(\frac{85}{16})=-16(\frac{85}{16})^2+170(\frac{85}{16})+6=\frac{7321}{16}=457.5625$

$\boxed{\text{The max ht is } 457.563' \text{ at } 5.313 \text{ sec after launch.}}$

c. When will the rock hit the ground? Determine the answer algebraically and graphically.

$h=0$

$0=-16t^2+170t+6$



$t=\frac{-170\pm\sqrt{170^2-4(-16)(6)}}{2(-16)}=\frac{-170\pm\sqrt{29284}}{-32}$

$=-.035$ or $\boxed{10.660 \text{ sec}}$

Write the statement as a power function equation. Use k as the constant of variation. ***(2-2)***

22. The area of an equilateral triangle varies directly as the square of the side s.

$A=ks^2$

23. The height h of a cone with a fixed volume varies inversely as the square of its radius r.

$h=k\cdot r^{-2}$ $\quad h=\frac{k}{r^2}$

For questions 24 and 25, write an equation and solve the problem. ***(2-2)***

24. The period of vibration P for a pendulum varies $\boxed{\text{directly}}$ as the $\boxed{\text{square root}}$ of the length L. If the period of vibration is 3.5 sec when the length is 49 inches, find k, the constant of variation. Determine what the period when $L = 5.0625$ inches.

$P = k\sqrt{L}$

$3.5 = k\sqrt{49}$

$\frac{3.5}{7} = k$

$\frac{1}{2} = k$

$\boxed{P = \frac{1}{2}\sqrt{L}}$

$P = \frac{1}{2}\sqrt{5.0625}$

$\boxed{P = 1.125 \text{ sec}}$

25. The gravitational attraction A between two masses varies $\boxed{\text{inversely as the square}}$ of the distance between them. The force of attraction is 2.25 lb when the masses are 4 ft apart. Find k, the constant of variation, and determine what the attraction is when the masses are 6 ft apart.

$A = k \cdot d^{-2}$

or

$A = \frac{k}{d^2}$

$2.25 = \frac{k}{4^2}$

$36 = k$

$\boxed{A = \frac{36}{d^2} \text{ or } A = 36d^{-2}}$

$A = \frac{36}{6^2} = \boxed{1 \text{ lb}}$

26. The table shows the number of employees of the Gizmo Company. ***(2-4)***

Year	~~1972~~ 2	~~1975~~ 5	~~1978~~ 8	~~1980~~ 10	~~1983~~ 13	~~1986~~ 16
Num. of Employees	247	475	658	546	493	605

(a) Find a cubic regression equation, using $x =$ years after 1970. Round to the nearest thousandths for your equation.

$f(x) = .834x^3 - 25.871x^2 + 248.115x - 167.677$

(b) Use the original regression equation (NO ROUNDING) to predict the number of employees in 1990.

$x = 20$ in 1990 store all decimals!

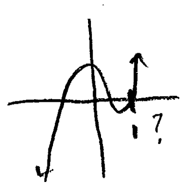
$\boxed{f(20) = 1118.123}$ or 1118 employees b/c you can't have .123 of person.

27. Use the Rational Zeros Theorem to list all the potential zeros of $f(x) = 6x^3 + x^2 - 10x + 3$. Then use synthetic division to find all zeros. ***(2-4)***

$p: \pm 1, \pm 3$

$q: \pm 1, \pm 2, \pm 3, \pm 6$

$\frac{p}{q}: \pm 1, \pm\frac{1}{2}, \pm\frac{1}{3}, \pm\frac{1}{6}, \pm 3, \pm\frac{3}{2}$



$$\begin{array}{r|rrrr} 1 & 6 & 1 & -10 & 3 \\ & & 6 & 7 & -3 \\ \hline & 6 & 7 & -3 & 0 \end{array}$$

$6x^2 + 7x - 3 = 0$

$-18 \mid 7$

-2.9

	$3x$	-1
$2x$	$6x^2$	$-2x$
$+3$	$+9x$	-3

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

$\boxed{x = 1 \quad x = \frac{1}{3} \quad x = \frac{-3}{2}}$