MAT 201 S1.2 I #s 2, 4, 6, 8, 9, 11, 14

#s 1, 2: Classify each function as a power function, root function, polynomial function (State its degree), rational function, algebraic function, trig. function, exponential function, or logarithmic function.

(2) a. $y = \frac{x \cdot 6}{x+6}$

① rational function
② algebraic function

b. $y = x + \frac{x^2}{\sqrt{x-1}}$

algebraic function

c. $y = 10^x$

① exponential function
② transcendental function

d. $y = x^{10}$

① power function
② polynomial (degree 10)

e. $y = 2t^6 + t^4 - \pi$

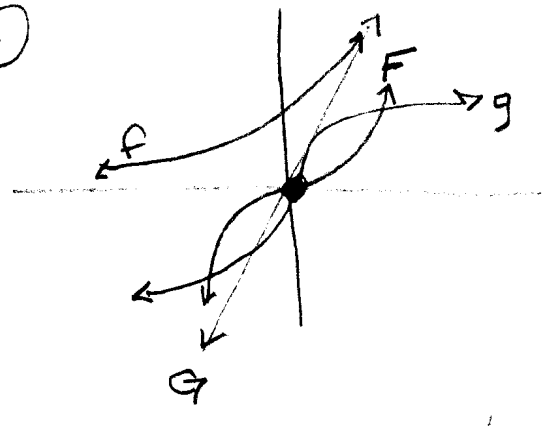
polynomial function (degree 6)

f. $y = \cos\theta + \sin\theta$

① trigonometric
② transcendental

#s 3, 4: Match each function with its graph.

(4)



(a) $y = 3x$ is G

(b) $y = 3^x$ is f

(c) $y = x^3$ is F

(d) $y = \sqrt[3]{x}$ is g

(6) What do all members of the family of linear functions of the form $f(x) = 1 + m(x+3)$ have in common? Sketch several members. (Try different "m"s)

ANS

They all pass thru the point $(-3, 1)$!

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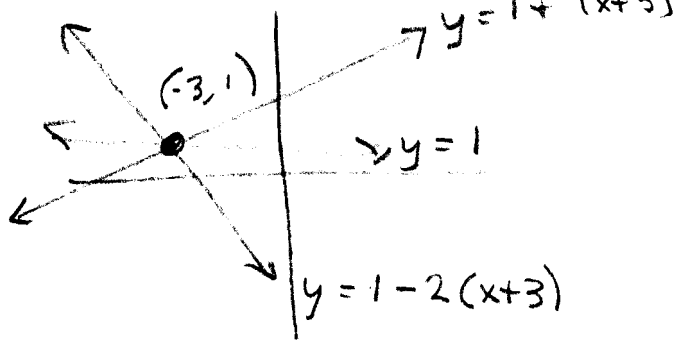
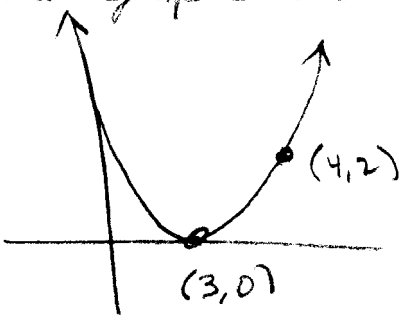
(6) cont'd.



(8) Find expressions for the quadratic functions whose graphs are shown.



$f(x) = a(x-3)^2 + 0$

$f(4) = a(4-3)^2 = 2$

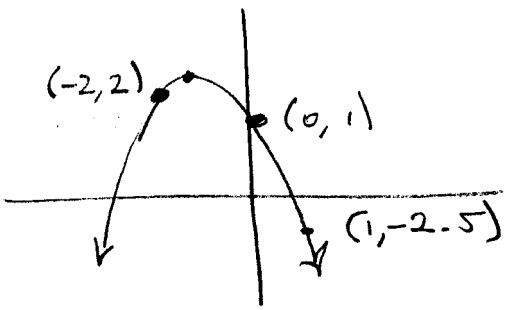
$a(1)^2 = 2$

$a = 2$

$\Rightarrow f(x) = 2(x-3)^2$

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

$= \boxed{2x^2 - 12x + 18 = f(x)}$



$f(x) = ax^2 + bx + c$

$f(0) = a(0)^2 + b(0) + c = 1$

$\Rightarrow c = 1$

$\Rightarrow f(x) = ax^2 + bx + 1$

Now, $f(-2) = a(-2)^2 + b(-2) + 1$

$= 4a - 2b + 1 = 2$

& $f(1) = a(1)^2 + b(1) + 1$

$= a + b + 1 = -2.5$

So, $4a - 2b = 1$ ②

$a + b = -1.5$

$\Rightarrow a = b - 1.5$

$\Rightarrow 4(b - 1.5) - 2b = 1$

$\Rightarrow 4b - 6 - 2b = 1$

$\Rightarrow 2b = 7 \Rightarrow b = \frac{7}{2} = 3.5$

$\Rightarrow a = 3.5 - 1.5 = \boxed{2 = a}$

So, $\boxed{f(x) = 2x^2 + 3.5x + 1}$

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(9) Find an expression for a cubic function f if $f(1)=6$ & $f(-1)=f(0)=f(2)=0$.

SOLN $f(x)=a(x+1)(x-0)(x-2)$ by 2nd condition.

The 1st condition gives

$$f(1)=a(1+1)(1-0)(1-2)=6$$

$$\Longrightarrow a(2)(1)(-1)=-2a=6 \text{ — } a=-3, \text{ so}$$

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

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

$$=\boxed{-3x^3+3x^2+6x=f(x)}$$

(11) The recommended adult dosage for a drug is D (in mg). The dosage, c, for a child of age a is given by $c=.041D(a+1)$. Suppose $D=200$ mg.

(a) Find the slope of the line c:

$$c=.041(200)(a+1)$$

$$=8.2(a+1)=8.2a+8.2$$

Slope is 8.2. It represents the rate of change in dosage for a unit increase in age of the child. It's in units of $\frac{mg}{yr}$.

(b) The dosage for a newborn is

$$8.2(0+1)=\boxed{8.2 \text{ mg}}$$

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(14) Jason leaves Detroit @ 2:00 p.m. and drives at a constant speed. At 2:50 pm, he's 40 miles away.

(a) Express distance traveled in terms of the elapsed time. (in minutes, I presume)

$(t_1, d_1) = (0,0)$, $(t_2, d_2) = (50,40)$

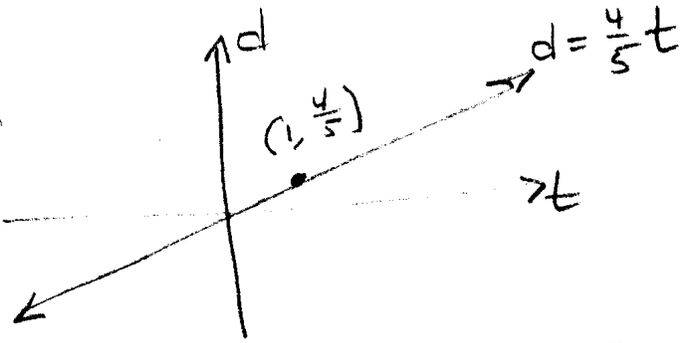
$m = \frac{d_2 - d_1}{t_2 - d_1} = \frac{40}{50} = \frac{4}{5}$, so $d = m(t - t_1) + d_1$

d = miles traveled

t = time (in minutes)

$$\boxed{d = \frac{4}{5}t}$$

(b) Sketch its graph



(c) Slope is $m = \frac{4}{5}$. It is the rate of change in distance with respect to time, in units of $\frac{\text{miles}}{\text{min}}$. It represents his speed.