

## MATHEMATICS 201-009-50

Precalculus

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Fall 2007

# XII – Polynomials

1. Sketch the graph of the function.

a)  $f(x) = x^3 - 8$

c)  $f(x) = (x-2)^4$

e)  $f(x) = -x^5 + 1$

g)  $f(x) = 1 - x^{100}$

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

d)  $f(x) = -(x+1)^4 + 2$

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

h)  $f(x) = (x+1)^{101} - 1$

2. Divide the following fractions.

a)  $\frac{3x^2 - 4x + 5}{x - 4}$

c)  $(x^3 - x^2 + 2x - 5) \div (x + 2)$

e)  $\frac{8x^3 - 4x^2 + 5x - 2}{2x + 3}$

g)  $\frac{x^3 + 8}{x^2 - 1}$

i)  $\frac{x^4 + 2x^3 - 5x}{x^2 - x + 5}$

k)  $\frac{x^4 - 2x^3 - 11x^2 + 12x + 36}{x - 3}$

b)  $\frac{6x^2 + 2x - 9}{3x + 1}$

d)  $(2x^3 - 5x + 2) \div (x + 4)$

f)  $\frac{4x^3 - 3x^2 + x - 4}{x^2 - x + 1}$

h)  $\frac{x^4 - 3x^2 + 2x - 5}{x + 3}$

j)  $\frac{x^5 - 3x^3 - 2x + 2}{x^2 + 3x - 1}$

l)  $\frac{x^4 - 1}{(x-1)^2}$

3. List all possible rational zeros (don't check which ones actually are).

a)  $p(x) = x^3 - x + 12$

c)  $p(x) = 6x^4 - 3x^2 + 8$

b)  $p(x) = 2x^3 - x^2 + 4$

4. Factor the following polynomials.

a)  $p(x) = x^3 + 2x^2 - x - 2$

c)  $p(x) = x^3 + 3x^2 - 6x - 8$

e)  $p(x) = 4x^3 + 4x^2 - x - 1$

g)  $p(x) = x^4 + x^3 - 3x^2 - 5x - 2$

i)  $p(x) = x^4 - 13x^2 + 36$

k)  $p(x) = x^5 - 16x^3 + 38x^2 - 33x + 10$

m)  $p(x) = x^7 - 2x^6 + 2x^4 - x^3$

b)  $p(x) = x^3 + x^2 - 8x - 12$

d)  $p(x) = x^3 - 9x^2 + 27x - 27$

f)  $p(x) = 8x^3 - 4x^2 - 2x + 1$

h)  $p(x) = x^4 - 10x^3 + 35x^2 - 50x + 24$

j)  $p(x) = x^4 + 4x^3 + 6x^2 + 4x + 1$

l)  $p(x) = x^5 - 10x^4 + 40x^3 - 80x^2 + 80x - 32$

n)  $p(x) = x^4 - 625$

5. Solve the following equations.

a)  $x^3 + x^2 - 17x + 15 = 0$

c)  $x^3 - 2x^2 - 3x + 6 = 0$

e)  $x^3 - 2x^2 - 9x - 2 = 0$

g)  $x^5 - 7x^4 - 5x^3 + 3x^2 = 0$

b)  $x^3 - 21x - 20 = 0$

d)  $x^3 + 2x^2 - 13x - 6 = 0$

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

h)  $4x^4 - 51x^2 - 49x - 12 = 0$

6. Find a polynomial of the specified degree with the following zeros.

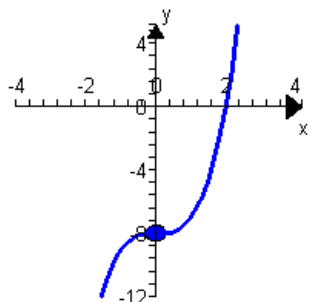
a) Degree 3: zeros -3, 2, 5

b) Degree 4: zeros -2, 0, 2, 3

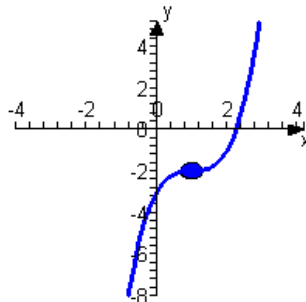
c) Degree 5: zeros -2, -1, 0, 1, 2

## ANSWERS

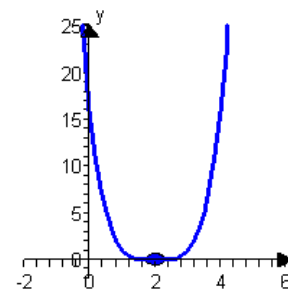
1. a)

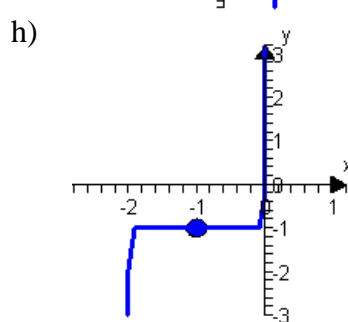
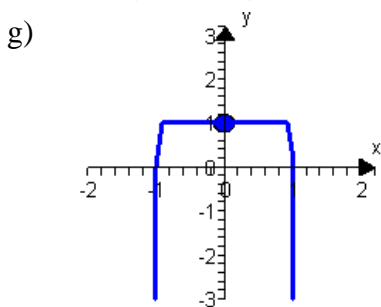
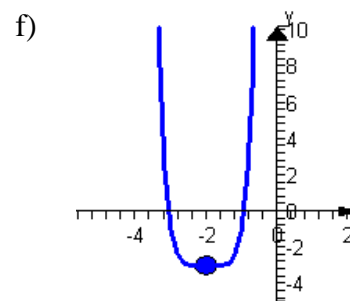
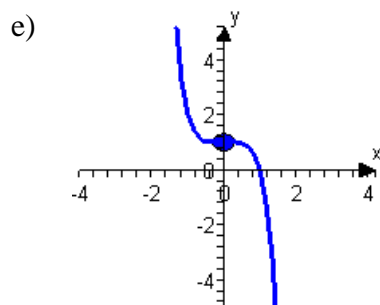
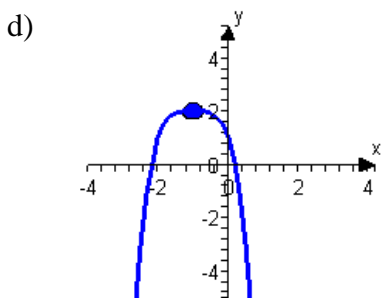


b)



c)





i)

2. a)  $3x + 8 + \frac{37}{x-4}$

d)  $2x^2 - 8x + 27 - \frac{106}{x+4}$

g)  $x + \frac{x+8}{x^2-1}$

j)  $x^3 - 3x^2 + 7x - 24 + \frac{77x-22}{x^2+3x-1}$

b)  $2x - \frac{9}{3x+1}$

e)  $4x^2 - 8x + \frac{29}{2} - \frac{91}{2(2x+3)}$

h)  $x^3 - 3x^2 + 6x - 16 + \frac{43}{x+3}$

k)  $x^3 + x^2 - 8x - 12$

c)  $x^2 - 3x + 8 - \frac{21}{x+2}$

f)  $4x + 1 - \frac{2x+5}{x^2-x+1}$

i)  $x^2 + 3x - 2 - \frac{22x-10}{x^2-x+5}$

l)  $x^2 + 2x + 3 + \frac{4x-4}{x^2-2x+1}$

3. a)  $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

b)  $\pm \frac{1}{2}, \pm 1, \pm 2, \pm 4$

c)  $\pm \frac{1}{6}, \pm \frac{1}{3}, \pm \frac{1}{2}, \pm \frac{2}{3}, \pm 1, \pm \frac{4}{3}, \pm 2, \pm \frac{8}{3}, \pm 4, \pm 8$

4. a)  $(x-1)(x+1)(x+2)$

b)  $(x-3)(x+2)^2$

c)  $(x-2)(x+1)(x+4)$

d)  $(x-3)^3$

e)  $(2x+1)(2x-1)(x+1)$

f)  $(2x+1)(2x-1)^2$

g)  $(x+1)^3(x-2)$

h)  $(x-1)(x-2)(x-3)(x-4)$

i)  $(x+2)(x-2)(x+3)(x-3)$

j)  $(x+1)^4$

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

l)  $(x-2)^5$

m)  $x^3(x-1)^3(x+1)$

n)  $(x-5)(x+5)(x^2+25)$

5. a) -5, 1, 3

b) -4, -1, 5

c)  $\pm\sqrt{3}, 2$

d)  $3, \frac{5}{2} \pm \frac{1}{2}\sqrt{17}$

e)  $-2, 2 \pm \sqrt{5}$

f) -2, 1, 3

g)  $-1, 4 \pm \sqrt{13}$

h)  $-3, \frac{1}{2}, 4$

6. a)  $x^3 - 4x^2 - 11x + 30$

b)  $x^4 - 3x^3 - 4x^2 + 12x$

c)  $x^5 - 5x^3 + 4x$