

Key

Pre-Calculus 30  
Writing Equations of Polynomial Functions

Determine the equation of each polynomial with the following characteristics. Leave the answer in factored form.  $P(x) = a(x-r)(x-r)(x-r)(x-r)(x-r)$

1. A cubic equation; with roots at  $x = 3$ ,  $x = -6$  and  $x = 2$  with a y-intercept of 108.  $(0, 108)$

$$P(x) = a(x-3)(x+6)(x-2)$$
$$108 = a(0-3)(0+6)(0-2)$$
$$108 = 36a$$
$$a = 3$$

$$P(x) = 3(x-3)(x+6)(x-2)$$

2. A function that passes through the point  $(2, 28)$  and has x-intercepts at  $(6, 0)$ ,  $(-5, 0)$ ,  $(0, 0)$  and  $(1, 0)$ .

$$P(x) = a(x-6)(x+5)(x)(x-1)$$
$$28 = a(2-6)(2+5)(2)(2-1)$$
$$28 = -56a$$
$$a = -\frac{1}{2}$$

$$P(x) = -\frac{1}{2}x(x-6)(x+5)(x-1)$$

3. A function with roots at  $x = 3$  (multiplicity of 2) and  $x = -1$  (multiplicity of 3) and has a y-intercept of  $(0, 45)$

$$P(x) = a(x-3)^2(x+1)^3$$
$$45 = a(0-3)^2(0+1)^3$$
$$45 = 9a$$
$$a = 5$$

$$P(x) = 5(x-3)^2(x+1)^3$$

4. A function 4<sup>th</sup> degree function with roots at  $x = 5$ ,  $x = 1$ , and  $x = -3$  (multiplicity of 2) passing through the point  $(-2, 14)$

$$P(x) = a(x-5)(x-1)(x+3)^2$$
$$14 = a(-2-5)(-2-1)(-2+3)^2$$
$$14 = 21a$$
$$a = \frac{2}{3}$$

$$P(x) = \frac{2}{3}(x-5)(x-1)(x+3)^2$$

5. A quadratic function with root  $x=1$  (multiplicity of 2) passing through the point  $(2, -1)$

$$P(x) = a(x-1)^2$$

$$-1 = a(2-1)^2$$

$$-1 = a$$

$$P(x) = -1(x-1)^2$$

6. A polynomial passing through the point  $(3, -2.5)$  with x-intercepts at  $(-2, 0)$ ,  $(4, 0)$  and  $(-2, 0)$

$$P(x) = a(x+2)(x-4)(x+2)$$

$$P(x) = a(x+2)^2(x-4)$$

$$-2.5 = a(3+2)^2(3-4)$$

$$-2.5 = -25a$$

$$a = +1/10$$

$$P(x) = +1/10(x+2)^2(x-4)$$

7. A cubic function with a root  $x=3$  (multiplicity of 3) passing through  $(0, 54)$

$$P(x) = a(x-3)^3$$

$$54 = a(0-3)^3$$

$$54 = -27a$$

$$a = -2$$

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

8. A function with a y-intercept at  $(0, 5)$  and a x-intercept at  $(-2, 0)$

$$P(x) = a(x+2)^n$$

$$5 = a(0+2)$$

$$5 = 2a$$

$$a = 5/2$$

$$P(x) = 5/2(x+2)^n$$