

**MATH 30 - Precalculus, Version A**

**First Midterm. Time allowed: 2 hours, 15 minutes.** Professor Luis Fernández

NAME: \_\_\_\_\_

[6] **1.** Carefully write down the statement of the Remainder Theorem:

[6] **2.** Suppose that we divide the polynomial  $p(x) = x^{100} + 5x^{50} - 6x^{23} + 5$  by  $(x + 1)$ . What remainder do we get?

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[10] **3.** Divide using long division and write the answer as  $D = d \cdot q + r$ , where  $D$  is the dividend,  $d$  is the divisor,  $q$  is the quotient and  $r$  is the remainder.

$$\frac{6x^3 - 8x^2 - 24x - 11}{2x + 2}$$

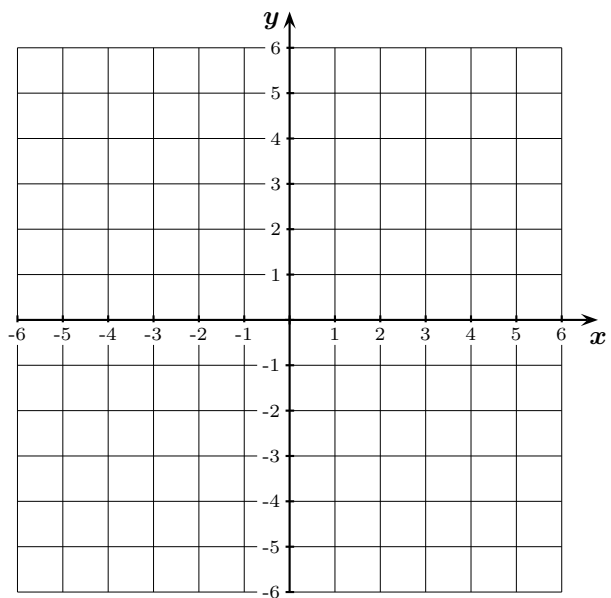
- [10] 4. **List** all the possible rational roots of the polynomial  $3x^6 - 3x^2 - 15x + 4$ .  
NOTE: You are only asked to list them, NOT to factor the polynomial.

- [12] 5. Find the equation of the line perpendicular to the line  $y = \frac{2x}{3} + 4$  and passing through the point  $(1, 2)$ .

[12] **6.** Consider the line given by the equation  $2x + 3y = 6$ .

**a)** Find its slope and  $y$ -intercept.

**b)** Graph the line in the coordinate axes below.



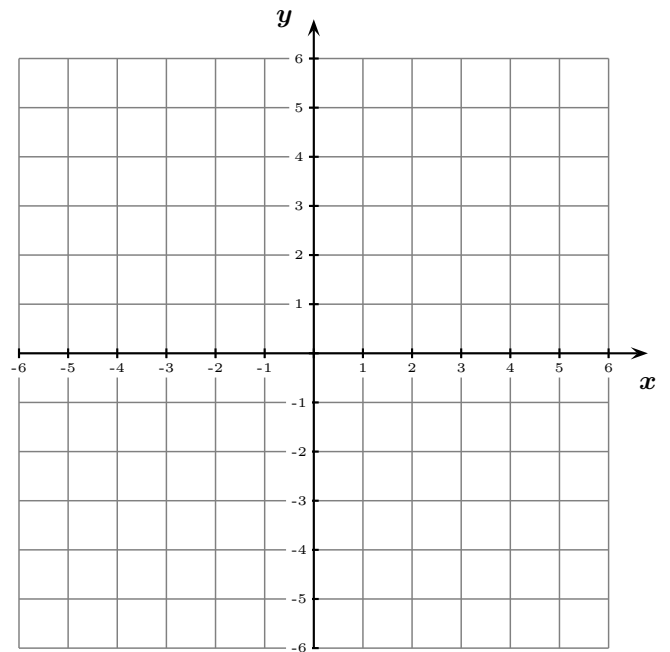
[12] 7. For the quadratic function  $f(x) = -2(x - 2)^2 + 4$ ,

a) Find the vertex.

b) Find the  $x$ -intercepts, if any.

c) Find the  $y$ -intercepts.

d) Determine whether the parabola opens up or down.  
Sketch the graph on the coordinate axes provided.



[12] **8.** Find all the solutions of the equation  $x^3 - 5x^2 + 6x - 2 = 0$ .

[NOTE: one of the solutions is rational, so it can be found using synthetic division. The other two are irrational; to find them you need to use the quadratic formula or complete the square.]

[12] **9.** Factor completely the polynomial  $f(x) = x^4 + 2x^3 - 4x^2 - 2x + 3$ .

[12] **10.** The polynomial  $f(x) = x^3 - 3x + 2$  can be factored as  $f(x) = (x - 1)^2(x + 2)$ .

a) Find the end behavior of  $f$ .

b) Find the  $x$ -intercepts of  $f$  and their multiplicity, and the local behavior at the intercepts.

c) Find the  $y$ -intercept of  $f$ .

d) Sketch the graph of  $f$  in the axes provided.

