

Simplify, so that the answer is in form $a + bi$.

$$1. \text{ (4pts) } 4 - 3i + (3 - i) \cdot 4i = 4 - 3i + 12i - 4i^2 = 8 + 9i$$

$$2. \text{ (6pts) } \frac{5 + 7i}{4 - 3i} = \frac{5 + 7i}{4 - 3i} \cdot \frac{4 + 3i}{4 + 3i} = \frac{20 + 28i + 15i + 21i^2}{16 - 9i^2} = \frac{-1 + 43i}{16 + 9} = \frac{-1 + 43i}{25}$$

3. (4pts) Simplify and justify your answer.

$$i^{213} = i^{212} \cdot i = (i^4)^{53} \cdot i = 1 \cdot i = i$$

4. (8pts) The amount of food (in tons) arriving daily to a hurricane-stricken area is given by $A(x) = -x^2 + 20x + 15$, where x is the number of days after September 20th. On what dates were 106 tons arriving daily?

$$-x^2 + 20x + 15 = 106$$

$$x^2 - 20x + 91 = 0$$

$$(x - 7)(x - 13) = 0$$

$x = 7, 13$ days after Sep. 20th

Sep. 27th and Oct. 3rd

5. (8pts) Solve the equation: $x^4 + 3x^2 - 40 = 0$

$$\text{Let } u = x^2 \quad (x^2)^2 + 3x^2 - 40 = 0$$

$$u^2 + 3u - 40 = 0$$

$$(u + 8)(u - 5) = 0$$

$$u = -8, 5$$

$$x^2 = -8 \text{ or } x^2 = 5$$

$$x = \pm\sqrt{8}i \quad x = \pm\sqrt{5}$$

$$= \pm 2\sqrt{2}i$$

6. (6pts) Solve by completing the square.

$$x^2 - 14x + 42 = 0 \quad | +7^2$$

$$x^2 - 2 \cdot x \cdot 7 + 7^2 + 42 = 7^2$$

$$(x - 7)^2 = 49 - 42$$

$$(x - 7)^2 = 7$$

$$x - 7 = \pm\sqrt{7}$$

$$x = 7 \pm \sqrt{7}$$

8. (12pts) The quadratic function $f(x) = 4x^2 - 4x - 15$ is given. Do the following without using the calculator.

a) Find the x -intercepts of its graph, if any. Find the y -intercept.

b) Find the vertex of the graph.

c) Sketch the graph of the function.

$$\text{Vertex: } h = -\frac{b}{2a} = -\frac{-4}{2 \cdot 4} = \frac{1}{2}$$

$$k = f\left(\frac{1}{2}\right) = 4 \cdot \left(\frac{1}{2}\right)^2 - 4 \cdot \frac{1}{2} - 15 = -16$$

c) y -int: $f(0) = -15$

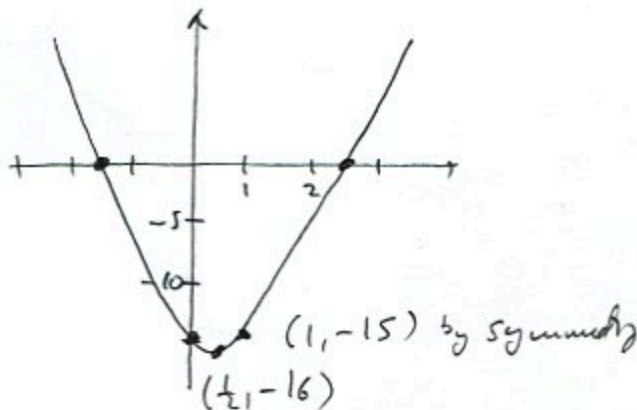
x -int:

$$4x^2 - 4x - 15 = 0 \quad 16 + 240$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \cdot 4 \cdot (-15)}}{2 \cdot 4}$$

$$= \frac{4 \pm \sqrt{256}}{8} = \frac{4 \pm 16}{8} = \frac{20}{8}, -\frac{12}{8}$$

$$= \frac{5}{2}, -\frac{3}{2}$$



9. (12pts) Greg is in charge of irrigating a large field and his weekly pay depends on the weekly rainfall. His base pay of \$10 an hour is supplemented by hardship hourly pay of \$1 per inch of rainfall (for working in a muddy field). However, if it rains, less work on irrigation is needed, so his 40 weekly hours are reduced by 2 hours per inch of rainfall. One week, Greg was paid \$442. How many inches of rain fell during that week?

weekly pay = hours worked \cdot hourly pay $x =$ amount of rainfall

$$442 = (40 - 2x)(10 + 1 \cdot x)$$

$$442 = (40 - 2x)(10 + x)$$

$$442 = 400 - 20x + 40x - 2x^2$$

$$442 = 400 + 20x - 2x^2$$

$$2x^2 - 20x + 42 = 0 \quad | \div 2$$

$$x^2 - 10x + 21 = 0$$

$$(x-3)(x-7) = 0$$

$x = 3$ or 7 inches of rainfall