

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

1. (4pts) $4 + (5i - 1) \cdot 2i = 4 + \underbrace{10i^2}_{=-10} - 2i = -6 - 2i$

2. (6pts) $\frac{3+5i}{2-3i} = \frac{3+5i}{2-3i} \cdot \frac{2+3i}{2+3i} = \frac{(3+5i)(2+3i)}{2^2 - (3i)^2} = \frac{6 + 10i + 9i + 15i^2}{4 - \underbrace{9i^2}_{=-9}}$
 $= \frac{-9 + 19i}{13}$

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

$i^{103} = i^{100} \cdot i^3 = \underbrace{(i^4)^{25}}_{=1} \cdot i^3 = i^3 = -i$

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?

$-x^2 + 20x + 15 = 106$ $x = 7$ or $x = 13$
 $x^2 - 20x - 15 = -106$
 $x^2 - 20x + 91 = 0$ \downarrow
 $(x-7)(x-13) = 0$ Sep. 27th and Oct 3rd

5. (8pts) Solve the equation: $2x^4 + 7x^2 - 15 = 0$

Let $u = x^2$. Equation takes form

$2u^2 + 7u - 15 = 0$
 $u = \frac{-7 \pm \sqrt{7^2 - 4 \cdot 2 \cdot (-15)}}{2 \cdot 2} = \frac{-7 \pm \sqrt{169}}{4} = \frac{-7 \pm 13}{4} = \frac{3}{2}, -5$

$x^2 = \frac{3}{2}$ or $x^2 = -5$

$x = \pm \sqrt{\frac{3}{2}}$ $x = \pm \sqrt{5}i$

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

$x^2 - 12x + 8 = 0$ $+6^2 - 8$

$x - 6 = \pm \sqrt{28}$

$x^2 - 2 \cdot x \cdot 6 + 6^2 = 6^2 - 8$

$x = 6 \pm 2\sqrt{7}$

$(x-6)^2 = 28$

7. (12pts) The quadratic function $f(x) = x^2 + 3x - 28$ 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.

$$a) \quad x^2 + 3x - 28 = 0$$

$$(x+7)(x-4) = 0$$

$$x = -7, 4$$

$$f(0) = -28 \text{ } y\text{-int.}$$

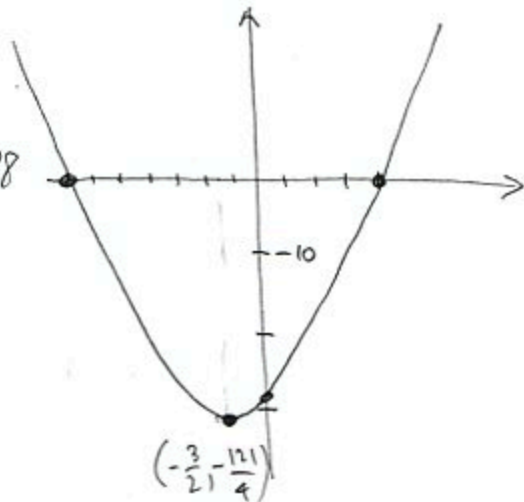
$$b) \quad h = -\frac{3}{2 \cdot 1} = -\frac{3}{2}$$

$$k = \left(-\frac{3}{2}\right)^2 + 3 \cdot \left(-\frac{3}{2}\right) - 28$$

$$= \frac{9}{4} - \frac{9}{2} - 28$$

$$= -\frac{9}{4} - 28$$

$$= -\frac{121}{4} = -30\frac{1}{4}$$



8. (12pts) Greg is in charge of irrigating a large field and his weekly pay depends on the weekly rainfall. His base pay of \$11 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 \$476. How many inches of rain fell during that week?

$$\text{Weekly pay} = \text{hourly pay} \cdot \text{no. of hours worked}$$

$$x = \text{rainfall during week (in inches)}$$

$$476 = (11+x)(40-2x)$$

$$440 + 40x - 22x - 2x^2 = 476$$

$$-2x^2 + 18x - 36 = 0 \quad | \div (-2)$$

$$x^2 - 9x + 18 = 0$$

$$(x-3)(x-6) = 0$$

$$x = 3, 6$$

Either 3 or 6 inches of rain fell during the week.