| College Algebra — Joysheet 8<br>MAT 140, Spring 2025 — D. Ivanšić | Name: Saul Ocean<br>*Covers: 3.1, 3.2, 3.3 Show all your work!* |
|---|---|

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

**1.** (4pts) $3i(1+i) - 2(5+5i) = 3i + 3i^2 - 10 - 10i$

$= -7i - 3 - 10 = -13 - 7i$

**2.** (6pts) $\dfrac{2-i}{4-5i} = \dfrac{2-i}{4-5i} \cdot \dfrac{4+5i}{4+5i} = \dfrac{8+10i-4i-5i^2}{4^2-(5i)^2} = \dfrac{8+6i+5}{16+25} = \dfrac{13+6i}{41}$

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

$i^{325} = i^{324} \cdot i = (\underbrace{i^4}_{=1})^{81} \cdot i = 1 \cdot i = i$

$324 = 4 \cdot 81$, $\underbrace{\;}_{=1}$

**4.** (8pts) The number of flat screen TVs (in thousands) at a warehouse is described by the function $N(x) = -x^2 + 8x + 84$, where $x$ is the number of days after January 20th.
a) On what dates did the warehouse have 64 thousand flat screen TVs?
b) On what date did the number of flat screen TVs reach its maximum?

a) $-x^2 + 8x + 84 = 64$

$-x^2 + 8x + 20 = 0$

$x^2 - 8x - 20 = 0$

$(x-10)(x+2) = 0$

$x = 10, -2$

$x = 10$ is Jan 30th

$x = -2$ is Jan 18th

b) $h = -\frac{b}{2a} = -\frac{8}{2(-1)} = 4$

On Jan 24th

**5.** (8pts) Solve the equation: $x^4 + 10x^2 + 21 = 0$

$(x^2)^2 + 10x^2 + 21 = 0$ Let $u = x^2$

$u^2 + 10u + 21 = 0$

$(u+3)(u+7) = 0$

$u = -3, -7$

$x^2 = -3$ $\quad$ $x^2 = -7$

$x = \pm\sqrt{3}i$ $\quad$ $x = \pm\sqrt{7}i$

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

$x^2 - 16x + 21 = 0$ $\quad 1 + 8^2$

$x^2 - 2 \cdot x \cdot 8 + 8^2 + 21 = 8^2$

$(x-8)^2 = 64 - 21$

$(x-8)^2 = 43$

$x - 8 = \pm\sqrt{43}$

$x = 8 \pm \sqrt{43}$

**7.** (12pts) The quadratic function $f(x) = 4x^2 + 8x - 21$ 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.

y-int: $f(0) = -21$

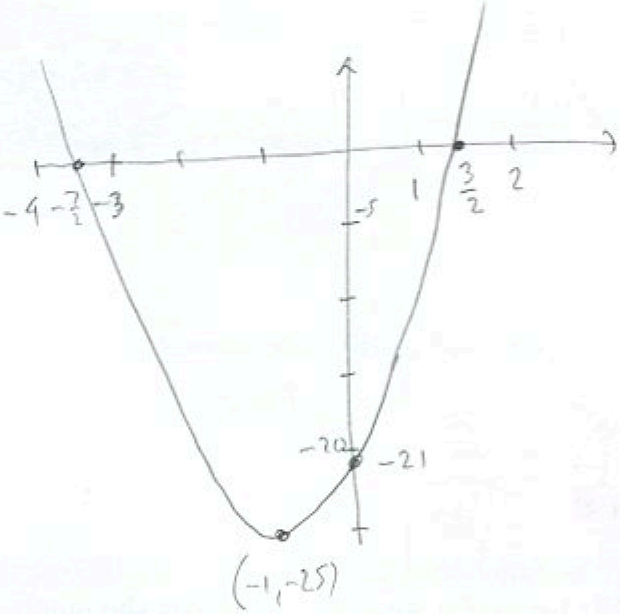
x-int: $4x^2 + 8x - 21 = 0$   $64 + 336$

$$x = \frac{-8 \pm \sqrt{8^2 - 4 \cdot 4 \cdot (-21)}}{2 \cdot 4} = \frac{-8 \pm \sqrt{400}}{8} = \frac{-8 \pm 20}{8}$$

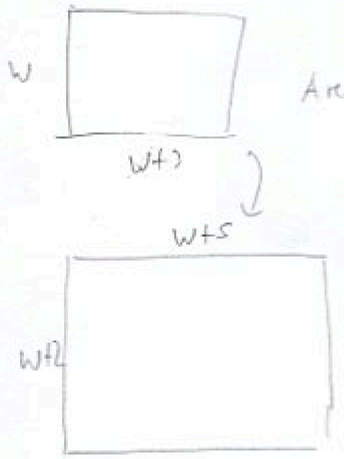
$$= \frac{12}{8}, \frac{-28}{8} = \frac{3}{2}, -\frac{7}{2}$$

b) $h = -\frac{b}{2a} = -\frac{8}{2 \cdot 4} = -1$

$k = f(-1) = 4 - 8 - 21 = -25$




**8.** (12pts) In a rectangle, the length is 3cm longer than the width. If we increase both width and length by 2cm, we get a rectangle with twice the area of the original one. What are the dimensions of the original rectangle?




Area $= w(w+3)$

Area $= (w+2)(w+5)$

$2w(w+3) = (w+2)(w+5)$

$2w^2 + 6w = w^2 + 7w + 10 \quad | -w^2 - 7w - 10$

$w^2 - w - 10 = 0$

$$w = \frac{-(-1) \pm \sqrt{(-1)^2 - 4 \cdot 1 \cdot (-10)}}{2 \cdot 1} = \frac{1 \pm \sqrt{41}}{2}$$

$\frac{1 - \sqrt{41}}{2} < 0$ so not a sol

$$w = \frac{1 + \sqrt{41}}{2} = 3.701562$$

$$l = w + 3 = \frac{7 + \sqrt{41}}{2} = 6.701562$$