College Algebra — Joysheet 8
MAT 140, Spring 2026 — D. Ivanšić

Name: Saul Ocon

Covers: 3.1, 3.2, 3.3 Show all your work!

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

1. (4pts) $(1+2i)^3 =$ $(1+2i)^2(1+2i) = (1^2+2\cdot1\cdot2i+(2i)^2)(1+2i)$

$= (1+4i+4i^2)(1+2i) = (-3+4i)(1+2i) = -3+4i-6i+8i^2 = -11-2i$ ($i^2=-1$)

~~$4i^2=-4$~~

2. (6pts) $\frac{7+i}{3-5i} = \frac{7+i}{3-5i}\cdot\frac{3+5i}{3+5i} = \frac{21+3i+35i+5i^2}{3^2-(5i)^2} = \frac{21+38i-5}{9-25i^2} = \frac{16+38i}{34} = \frac{2(8+19i)}{34}$ ($i^2=-1$)

$= \frac{8+19i}{17} = \frac{8}{17}+\frac{19}{17}i$

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

$i^{163} = i^{160+3} = i^{160}\cdot i^3 = 1\cdot i^2\cdot i = -i$

$(i^4)^{40} = 1^{40} = 1$

4. (8pts) The number of smartphones in a warehouse (in thousands) is described by the function $T(x) = x^2 - 14x + 70$, where x is the number of days after March 25th.

a) On what dates were there 37 thousand phones in the warehouse?

b) On what date did the number of smartphones in the warehouse reach its minimum?

a) $x^2-14x+70 = 37$ $x=3$ Mar 28th $x=11$ Apr 5th

$x^2-14x+33=0$

$(x-3)(x-11)=0$

$x=3, 11$

b) $-\frac{b}{2a} = -\frac{-14}{2\cdot1} = 7$

April 1st

5. (8pts) Solve the equation: $x^4+2x^2-63=0$

Let $u=x^2$

$(x^2)^2+2x^2-63=0$

$u^2+2u-63=0$

$(u+9)(u-7)=0$

$u=-9, 7$

$x^2=-9$ $x^2=7$

$x=\pm3i$ $x=\pm\sqrt{7}$

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

$x^2+10x+30=0$ $|+5^2$

$x^2+2\cdot x\cdot5+5^2+30=5^2$ $|-30$

$(x+5)^2=-5$

$x+5=\pm\sqrt{5}i$

$x=-5\pm\sqrt{5}i$

7. (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.

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

x-int: $-4x^2 + 4x + 15 = 0$

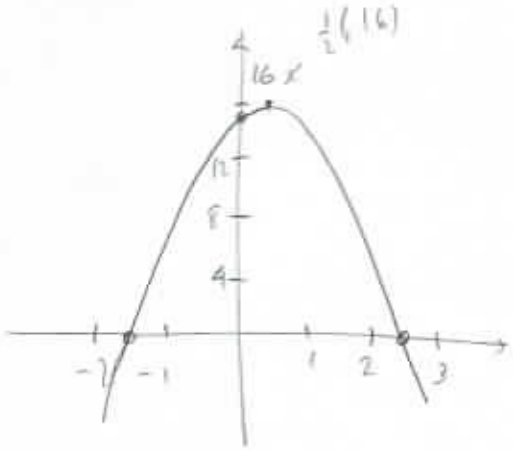
$4x^2 - 4x - 15 = 0$ $16 + 240$

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

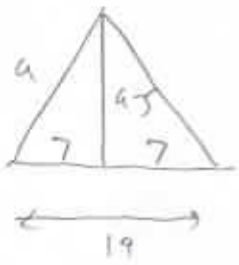
$= \dfrac{4 \pm \sqrt{256}}{8} = \dfrac{4 \pm 16}{8} = \dfrac{20}{8}, \dfrac{-12}{8} = \dfrac{5}{2}, -\dfrac{3}{2}$

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

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



8. (12pts) The base of an isosceles triangle is 14 cm (neither of the two equal sides is the base). If the height on that base is 5 cm shorter than the two equal sides of the triangle, what is the length of the equal sides?



$(a-5)^2 + 7^2 = a^2$

$a^2 - 10a + 25 + 49 = a^2$

$-10a + 74 = 0$

$10a = 74$

$a = \dfrac{74}{10} = 7.4$