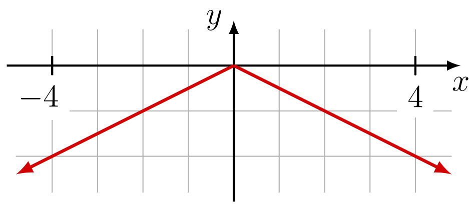
# Math 120 Exam #1 Key (Fall 2021)

**1a** Quadrants III, IV

**1b** Quadrant IV

**2**




**3a** Multiply by $2(x+3)(x-2)$ to get

$$6(x-2)=5(x-2)+2(x+3) \quad\Rightarrow\quad 6x-12=7x-4 \quad\Rightarrow\quad x=-8.$$

**3b** Equation becomes $4x+7=4x+7$, which is satisfied for any real $x$, and so the solution set is $\mathbb{R}$ (the set of real numbers).

**4** Say $x$ was invested at 15%, so that $15{,}000-x$ was invested at $-7\%$, and then

$$0.15x-0.07(15{,}000-x)=1590.$$

Solving gives $x=12{,}000$, so \$12,000 was invested at 15% and \$3000 was invested at $-7\%$.

**5** $b=\dfrac{2A}{h}-a.$

**6a** FOIL procedure gives $21-20i$.

**6b** $\dfrac{2+4i}{2-i}\cdot\dfrac{2+i}{2+i}=\dfrac{4+10i+4i^2}{4-i^2}=\dfrac{10i}{5}=2i.$

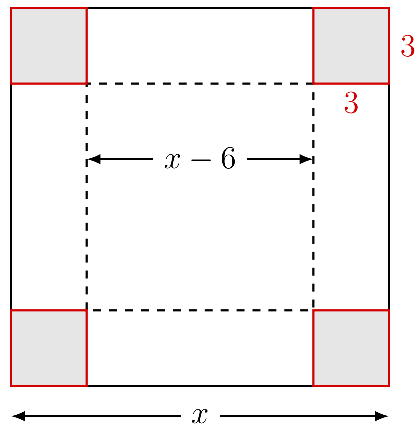
**7** The division $513/4$ has remainder 1, and so $i^{513}=i^1=i$.

**8a** Factors as $(4x-1)(x-3)=0$, so that $x=\frac{1}{4},3$.

**8b** We get $x^2-2x+1=\frac{3}{2}$, or $(x-1)^2=\frac{3}{2}$, so that $x=1\pm\sqrt{\frac{3}{2}}=1\pm\frac{\sqrt{6}}{2}$.

**8c** $x=\dfrac{2\pm\sqrt{(-2)^2-4(1)(17)}}{2(1)}=\dfrac{2\pm 8i}{2}=1\pm 4i.$

**9** Let the original sheet metal have sides of length $x$. Referring to the figure below, the volume $V$ of the resultant box will be $3(x-6)^2$, which must equal 80, and so $3(x-6)^2 = 80$. Solving this equation leads to $x = 6 \pm \sqrt{\frac{80}{3}}$. Since $x = 6 - \sqrt{\frac{80}{3}}$ results in $x - 6$ being negative, we must have $x = 6 + \sqrt{\frac{80}{3}}$. The dimensions of the box are thus $\sqrt{\frac{80}{3}}$ cm $\times \sqrt{\frac{80}{3}}$ cm $\times$ 3 cm.




**10a** Write $\sqrt{2x-3} = 1 + \sqrt{x-2}$, square to get $2x - 3 = 1 + 2\sqrt{x-2} + (x-2)$, and then isolate the remaining radical to get

$$2\sqrt{x-2} = x - 2 \quad \Rightarrow \quad 4(x-2) = (x-2)^2 \quad \Rightarrow \quad x^2 - 8x + 12 = 0.$$

The trinomial factors, giving $(x-6)(x-2) = 0$, and therefore $x = 2, 6$.

**10b** Factor: $(2x^{1/3} - 3)(x^{1/3} + 5) = 0$, so $2x^{1/3} = 3$ or $x^{1/3} = 5$, and hence $x = \frac{27}{8}, -125$. (The substitution $u = x^{1/3}$ may help but is not essential.)

**10c** We get $|x+1| = -4$, which is impossible and so the solution set is $\varnothing$.

**11a** Solving leads to $x \geq 8$, so the solution set is $[8, \infty)$.

**11b** We get $|2x+2| < 8$, implying $-8 < 2x + 2 < 8$, and finally $-5 < x < 3$. Solution set is $(-5, 3)$.

**11c** Divide by $-3$ to get $|x+7| \leq 9$, so $-9 \leq x + 7 \leq 9$, and therefore $-16 \leq x \leq 2$. Solution set is $[-16, 2]$.