Quadratic Equation Worksheets
(include complex solutions)

1. Compute the value of the discriminant of the quadratic equation in each part. Use the value of the discriminant to predict the number and type of solutions. Find all real and complex solutions.

$a)\ x = 2x^2 + 5$

b) $8x^2 + 4x + 32 = 0$

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$a)\ x = 2x^2 + 5$

We can rewrite this equation in standard form with $a = 2$, $b = -1$, and $c = 5$:

$$\mathbf{2x^2 - x + 5 = 0.}$$

$$\begin{aligned} b^2 - 4ac &= (-1)^2 - 4(2)(5) \\ &= 1 - 40 \\ &= -39. \end{aligned}$$

The discriminant is negative, so there will be two complex solutions. Using the quadratic formula,

$$x = \frac{-(-1) \pm \sqrt{-39}}{2(2)}$$

$$x = \frac{1 \pm i\sqrt{39}}{4}$$

The two solutions are $\frac{1}{4} + \frac{\sqrt{39}}{4}i$ and $\frac{1}{4} - \frac{\sqrt{39}}{4}i$

b) $8x^2 + 4x + 32 = 0$

We can factor 4 from the left side of this equation to obtain $4(2x^2 + x + 8) = 0$, and we know that a product is zero when one of the factors are zero. Since $4 \neq 0$, we must have $2x^2 + x + 8 = 0$. This is a quadratic equation with $a = 2$, $b = 1$, and $c = 8$. Then

$$b^2 - 4ac = 1^2 - 4(2)(8) = -63.$$

The discriminant is negative, so there will be two complex solutions. Using the quadratic formula,

$$x = \frac{-1 \pm \sqrt{-63}}{2(2)}$$

$$x = \frac{-1 \pm 3i\sqrt{7}}{4}.$$

The complex solutions are $-\frac{1}{4} + \frac{3\sqrt{7}}{4}i$ and $-\frac{1}{4} - \frac{3\sqrt{7}}{4}i$.