Practice Test: Factoring and Complex Numbers
Name: _____

1. Given the function: $f(x) = x^2 + 2x$.
   Calculate the rate of change in the function between $x = 1$ and $x = 5$.

2. Below is a function represented by a table. Determine if the function is "Linear", "Quadratic", or "Neither". You must give a valid reason for your answer in order to receive any credit.

x	y
−1	7
0	0
1	−5
2	−8
3	−9

Simplify the following as much as possible:

3. $(3 + 6i) + (-7 - 4i)$

4. $3i - (4i - 10) - 3$

Simplify the following as much as possible:

5. $3i(4 + 5i)$

Solve the following to 'x':

6. $2x^2 - 11 = 43$

7. $(x - 3)^2 + 10 = 18$

8. $4 - x^2 = 20$

9. $(2x + 1)^2 - 11 = 21$

Solve the following to 'x':

10. $\frac{1}{2} \cdot x^2 + 6 = 30$

11. $\frac{x^2}{3} + 4 = 2$

Solve the following for 'x' and 'y':

12. $6x - 9i = 3 + 12yi$

13. $16 + 11i = 2x^2 + 5yi$

Solve the following by "Factoring":

14. $x^2 + 7x + 12 = 0$

Solve the following by "Factoring":

15. $x^2 - 4x - 45 = 0$

16. $x^2 - 9x - 30 = 6$

17. $2x^2 - 5x + 3 = 0$

18. $3x^2 - 7x - 6 = 0$

Practice Test: Answers

1. Rate of change = slope = $\frac{y_2 - y_1}{x_2 - x_1}$

$x = 1$: $y = f(1) = -(1^2) + 2 \cdot 1 = 1$

$x = 5$: $y = f(5) = -(5^2) + 2 \cdot 5 = -25 + 10 = -15$

Rate of change = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-15 - 1}{5 - 1} = \frac{-16}{4} = -4$

2. Take 1st and 2nd differences:

x	y	1st differences	2nd differences
-1	7		
		$0 - 7 = -7$	
0	0		$-5 - (-7) = 2$
		$-5 - 0 = -5$	
1	-5		$-3 - (-5) = 2$
		$-8 - (-5) = -3$	
2	-8		$-1 - (-3) = 2$
		$-9 - (-8) = -1$	
3	-9		

2nd differences are the same, so it is "QUADRATIC".

3. $(3 + 6i) + (-7 - 4i) = (3 + -7) + (6i + -4i)$
$= -4 + 2i$

4. $3i - (4i - 10) - 3 = 3i - 4i + 10 - 3$
$= -i + 7$

5. $3i(4 + 5i) = 12i + 15i^2 \longrightarrow i^2 = -1$
$= 12i + 15 \cdot (-1) = 12i - 15$

6. $2x^2 - 11 = 43$
$+11 \quad +11$
$\frac{2x^2}{2} = \frac{54}{2}$
$\sqrt{x^2} = \sqrt{27} \longrightarrow x = \pm\sqrt{9}\sqrt{3} = \pm 3\sqrt{3}$

7. $(x-3)^2 + 10 = 18$

$-10 \quad -10$

$\sqrt{(x-3)^2} = \sqrt{8}$

$x - 3 = \pm\sqrt{4}\cdot\sqrt{2} = \pm 2\sqrt{2}$

$+3 \qquad +3$

$x = 3 \pm 2\sqrt{2}$

8. $4 - x^2 = 20$

$-4 \quad -4$

$\frac{-x^2}{-1} = \frac{16}{-1}$

$\sqrt{x^2} = \sqrt{-16} = \pm\sqrt{-1}\cdot\sqrt{16} = \pm 4i$

9. $(2x+1)^2 - 11 = 21$

$+11 \quad +11$

$\sqrt{(2x+11)^2} = \sqrt{32}$

$2x + 1 = \pm\sqrt{16}\sqrt{2} = \pm 4\sqrt{2}$

$-1 \qquad -1$

$\frac{2x}{2} = \frac{-1 \pm 4\sqrt{2}}{2} \longrightarrow x = \frac{-1 \pm 4\sqrt{2}}{2}$

10. $\frac{1}{2}x^2 + 6 = 30$

$-6 \quad -6$

$2\cdot\frac{1}{2}\cdot x^2 = 24\cdot 2$

$\sqrt{x^2} = \sqrt{48}$

$x = \pm\sqrt{16}\sqrt{3} = \pm 4\sqrt{3}$

11. $\frac{x^2}{3} + 4 = 2$

$-4 \quad -4$

$3\cdot\frac{x^2}{3} = -2\cdot 3$

$\sqrt{x^2} = \sqrt{-6}$

$x = \pm\sqrt{-1}\cdot\sqrt{6} = \pm i\sqrt{6}$

12. $6x - 9i = 3 + 12yi \longrightarrow \frac{6x}{6} = \frac{3}{6} \longrightarrow x = \frac{3}{6} = \frac{1}{2}$

$\frac{-9i}{12i} = \frac{12yi}{12i} \longrightarrow y = \frac{-9}{12} = \frac{-3}{4}$

13. $16 + 11i = 2x^2 + 5yi \longrightarrow \frac{16}{2} = \frac{2x^2}{2} \longrightarrow \sqrt{x^2} = \sqrt{8}$

$x = \pm\sqrt{4}\sqrt{2} = \pm 2\sqrt{2}$

$\frac{11i}{5i} = \frac{5yi}{5i} \longrightarrow y = \frac{11}{5}$ or 2.2

14. $x^2 + 7x + 12 = (x+3)(x+4) = 0$, because: • $3 \cdot 4 = 12$, and • $3 + 4 = 7$

$x + 3 = 0$ $\quad$ $x + 4 = 0$

$-3 \quad -3$ $\quad$ $-4 \quad -4$

$x = -3$ or $x = -4$

15. $x^2 - 4x - 45 = (x-9)(x+5) = 0$, because: • $(-9) \cdot 5 = -45$ • $(-9) + 5 = -4$

$x - 9 = 0$ $\quad$ $(x+5) = 0$

$+9 \quad 9$ $\quad$ $-5 \quad -5$

$x = 9$ or $x = -5$

16. $x^2 - 9x - 30 = 6 \longrightarrow$ set equal to 0 first

$-6 \quad -6$

$x^2 - 9x - 36 = 0$

$(x-12)(x+3) = 0$, because: • $(-12) \cdot 3 = -36$ • $(-12) + 3 = -9$

$x - 12 = 0$ $\quad$ $x + 3 = 0$

$+12 \quad 12$ $\quad$ $-3 \quad -3$

$x = 12$ or $x = -3$

17. $2x^2 - 5x + 3 = 0$

$2x \quad -3 \quad -3x$

$x \quad -1 \quad -2x$

$-5x$

So: $2x^2 - 5x + 3 =$

$(2x - 3)(x - 1) = 0$

$2x - 3 = 0$ | $x - 1 = 0$

$+3 \quad +3$ | $+1 \quad +1$

$\frac{2x}{2} = \frac{3}{2}$ | $x = 1$

$x = \frac{3}{2}$ or

18. $3x^2 - 7x - 6 = 0$

$3x \quad 2 \quad 2x$

$x \quad -3 \quad -9x$

$-7x$

So: $3x^2 - 7x - 6 =$

$(3x + 2)(x - 3) = 0$

$3x + 2 = 0$ | $x - 3 = 0$

$-2 \quad -2$ | $+3 \quad +3$

$\frac{3x}{3} = \frac{-2}{3}$ | $x = 3$

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