

1. Factor the following polynomials. Show your work.

(8 points)

(a) $x^2 + 9x + 20$

(a) $(x+5)(x+4)$

(b) $27 + 3x - 9x^3 - x^4$

(b) $3(9+x) - x^3(9+x)$

$(9+x)(3-x^3)$

2. Solve the quadratic equation by completing the square. Show your work. (5 points)

$$x^2 + 16x + 46 = 0$$

$$x^2 + 16x = -46$$

$$x^2 + 16x + 64 = -46 + 64$$

$$(x+8)^2 = 18$$

$$x+8 = \pm\sqrt{18} = \pm 3\sqrt{2}$$

$$x = -8 \pm 3\sqrt{2}$$

3. Perform the operation and write the result in the standard form. Show your work.

$$\begin{aligned} & \text{(a) } (4 - 7i)(6 + 4i) \\ &= 24 + 16i - 42i - 28i^2 \\ &= 24 - 26i + 28 \\ &= \boxed{52 - 26i} \end{aligned}$$

$$\begin{aligned} & \text{(b) } 4i^7 - 3i^4 \quad (8 \text{ points}) \\ &= 4(i^2)^3 i - 3(i^2)^2 \\ &= 4(-1)^3 i - 3(-1)^2 \\ &= \boxed{-4i - 3} \end{aligned}$$

4. Find all solutions to the equation. Check your solutions in the original equation. Show your work. (5 points)

$$\begin{aligned} 12x^4 - 48x^2 &= 0 \\ 12x^2(x^2 - 4) &= 0 \\ x^2(x-2)(x+2) &= 0 \end{aligned}$$

$$\boxed{x = 0, 2, -2}$$

Check 0
 $12(0)^4 - 48(0)^2 = 0 \checkmark$

Check 2
 $12(2)^4 - 48(2)^2$
 $= 12 \cdot 16 - 48 \cdot 4$
 $= 192 - 192$
 $= 0 \checkmark$

Check -2
 $12(-2)^4 - 48(-2)^2$
 $= 12 \cdot 16 - 48 \cdot 4$
 $= 192 - 192$
 $= 0 \checkmark$

5. Solve the inequality and sketch the solution on the real number line. Show your work. (8 points)

$$3|x-4| \geq 6$$

$$3(x-4) \geq 6$$

$$x-4 \geq 2$$

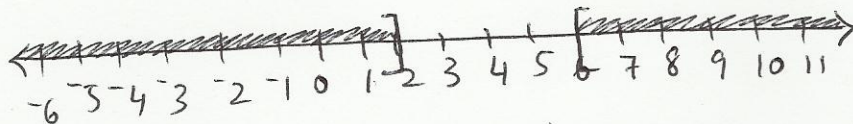
$$x \geq 6$$

$$-3(x-4) \geq 6$$

$$x-4 \leq -2$$

$$x \leq 2$$

$$(-\infty, 2] \cup [6, \infty)$$



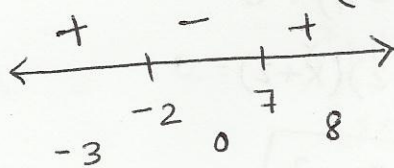
6. Solve the inequality and sketch the solution on the real number line. Show your work. (8 points)

$$x^2 - 5x + 4 < 18$$

$$x^2 - 5x - 14 < 0$$

$$(x-7)(x+2) < 0$$

Critical points
7, -2



At -3

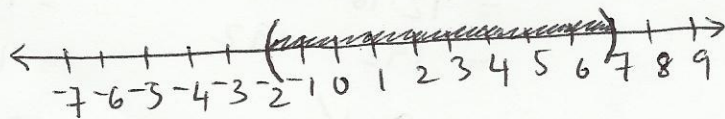
$$(-3-7)(-3+2) = -10 \cdot -1 = 10 > 0$$

Solution

$$(-2, 7)$$

At 0

$$(0-7)(0+2) = -7 \cdot 2 = -14 < 0$$



At 8

$$(8-7)(8+2) = 1 \cdot 10 = 10 > 0$$

7. Write the slope-intercept form of the equation of the line through the given point and perpendicular to the given line. Show your work. (8 points)

$$(-4, 2)$$

$$2x + 3y = -4$$

$$2x + 3y = -4$$

$$3y = -2x - 4$$

$$y = -\frac{2}{3}x - \frac{4}{3}, m = -\frac{2}{3}$$

$$\text{Slope of the new line} = -\frac{1}{-\frac{2}{3}} = \frac{3}{2}$$

Point-Slope form

$$(y - 2) = \frac{3}{2}(x + 4)$$

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Slope-intercept form

$$y = 2 + \frac{3x}{2} + 6$$

$$\boxed{y = \frac{3x}{2} + 8}$$