

## Questions From Homework

$$\textcircled{1} \text{ b) } x^2 - 9x + 14 \quad \begin{array}{l} -2 \times -7 = 14 \\ -2 + -7 = -9 \end{array}$$

$$(x-7)(x-2)$$

$$\textcircled{1} \text{ f) } 6y^2 - 11y + 3 \quad \begin{array}{l} -2 \times -9 = 18 \\ -2 + 9 = -11 \end{array}$$

$$(y-\frac{2}{6})(y-\frac{9}{6})$$

$$(y-\frac{1}{3})(y-\frac{3}{2})$$

$$(3y-1)(2y-3)$$

1, 8, 27, 64, 125... perfect cubes

$$\textcircled{2} \text{ c) } t^3 + 64 \quad a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$(t+4)(t^2 - 4t + 16)$$

$$\text{b) } x^3 - 1 \quad a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$(x-1)(x^2 + x + 1)$$

$$\textcircled{3} \text{ a) } (x^3 - x^2)(-16x + 16)$$

$$x^2(x-1) - 16(x-1)$$

$$(x-1)(x^2 - 16) \quad \leftarrow \text{Diff of square } a^2 - b^2 = (a-b)(a+b)$$

$$(x-1)(x+4)(x-4)$$

$$\textcircled{3} \text{ b) } x^3 + 2x^2 - 11x - 12 \quad x = -1$$

$$(-1)^3 + 2(-1)^2 - 11(-1) - 12 \quad (x+1) \text{ is a factor}$$

$$-1 + 2 + 11 - 12$$

0

$$\begin{array}{r} x^3 + 2x^2 - 11x - 12 \\ \underline{-(x^3 + x^2)} \\ x^2 - 11x - 12 \\ \underline{-(x^2 + x)} \\ -12x - 12 \\ \underline{-(-12x - 12)} \\ 0 \end{array}$$

$$\frac{4}{4} x^2 - 12$$

$$(x+1)(x^2 + x - 12)$$

$$(x+1)(x+4)(x-3)$$

## Questions From Homework

$$\textcircled{1} \text{ e) } 5x^2 + 13x + 6 \quad \begin{array}{l} \underline{10} \times \underline{3} = \underline{30} \\ \underline{10} + \underline{3} = \underline{13} \end{array}$$

$$(x + \frac{10}{5})(x + \frac{3}{5})$$

$$(x + 2)(5x + 3)$$

$$\textcircled{1} \text{ g) } t^3 + 2t^2 - 3t$$

$$t(t^2 + 2t - 3) \quad \begin{array}{l} \underline{-1} \times \underline{3} = \underline{-3} \\ \underline{-1} + \underline{3} = \underline{2} \end{array}$$

$$t(t-1)(t+3)$$

$$\textcircled{2} \text{ f) } x^6 + 8 \quad a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$(x^2 + 2)(x^4 - 2x^2 + 4)$$

$$\textcircled{2} \text{ g) } x^4 - 16$$

$$(x^2 + 4)(x^2 - 4)$$

$$(x^2 + 4)(x + 2)(x - 2)$$

$$\textcircled{3} \text{ b) } x^3 + 0x^2 - 7x + 6 \quad x=1$$

$$(1)^3 + 0(1)^2 - 7(1) + 6 \quad (x-1) \text{ is a factor}$$

$$1 + 0 - 7 + 6$$

$$0$$

$$\begin{array}{r|l} \underline{x-1} \overline{) x^3 + 0x^2 - 7x + 6} & (x-1)(x^2 + x - 6) \\ \underline{-(x^3 - x^2)} & (x-1)(x+3)(x-2) \\ \hline x^2 - 7x + 6 & \\ \underline{-(x^2 - x)} & \\ \hline -6x + 6 & \\ \underline{-(-6x + 6)} & \\ \hline 0 & \end{array}$$

## Questions From Homework

$$\textcircled{3} \text{ e) } 4x^3 + 12x^2 + 5x - 6$$

$$x = -2$$

$$4(-2)^3 + 12(-2)^2 + 5(-2) - 6$$

$$x + 2 = 0$$

$$-32 + 48 - 10 - 6 = 0$$

$$\begin{array}{r} \underline{x+2} \overline{) 4x^3 + 12x^2 + 5x - 6} \\ \underline{-(4x^3 + 8x^2)} \\ 4x^2 + 5x - 6 \\ \underline{-(4x^2 + 8x)} \\ -3x - 6 \\ \underline{-(-3x - 6)} \\ 0 \end{array}$$

$$\begin{array}{l} -2 + 6 = 4 \\ -2 \times 6 = -12 \end{array}$$

$$(x+2)(4x^2 + 4x - 3)$$

$$(x+2)(x - \frac{2}{4})(x + \frac{6}{4})$$

$$(x+2)(x - \frac{1}{2})(x + \frac{3}{2})$$

$$(x+2)(2x-1)(2x+3)$$

$$\textcircled{2} \text{ h) } r^8 - 1$$

$$x^2 - 4$$

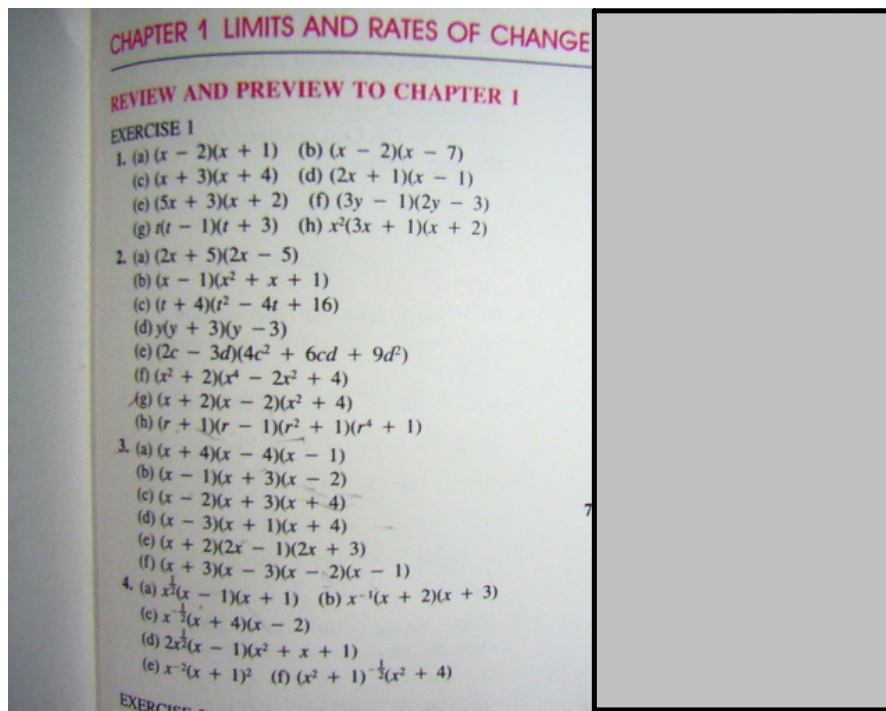
$$(x-2)(x+2)$$

$$(r^4 - 1)(r^4 + 1)$$

$$(r^2 - 1)(r^2 + 1)(r^4 + 1)$$

$$(r-1)(r+1)(r^2+1)(r^4+1)$$

## Answers to short sheet



## Synthetic Substitution

Factor using synthetic substitution  $x^3 - 7x^2 - 4x + 28$

Find a value of  $x$  that makes it equal 0

$$\begin{aligned} (\cancel{2})^3 - 7(\cancel{2})^2 - 4(\cancel{2}) + \cancel{28} \\ 8 - 28 - 8 + 28 = 0 \end{aligned}$$

( $x$ -value)

$$\begin{array}{r|l} \cancel{2} & \end{array}$$



$$(x - \cancel{2})(x^2 - 5x - 14)$$

$$(x - \cancel{2})(x - \cancel{7})(x + \cancel{2})$$

(Coefficients of the polynomial)

$$\begin{array}{r|rrrr} & 1 & -7 & -4 & 28 \\ & & \cancel{2} & -10 & -\cancel{28} \\ \hline & 1 & -5 & -14 & \end{array}$$



$$\begin{aligned} \underline{-7} \times \underline{\cancel{2}} &= -14 \\ \underline{-7} + \underline{\cancel{2}} &= -5 \end{aligned}$$

Bring down the first coefficient

Multiply the first coefficient by the  $x$ -value and place under the second coefficient. ADD.

Repeat the steps. The coefficients of the other factor are in the bottom row.

$$\begin{aligned} & (x^3 - 7x^2)(4x + 28) \\ & x^2(x-7) \cdot 4(x+7) \\ & (x-7)(x^2-4) \\ & (x-7)(x+2)(x-2) \end{aligned}$$

$$x^3 + 5x^2 - 2x - 24 \quad \text{Find a value of } x \text{ that makes it equal } 0$$

$$\begin{aligned} (-3)^3 + 5(-3)^2 - 2(-3) - 24 \\ -27 + 45 + 6 - 24 = 0 \end{aligned}$$

(x-value)

$$\underline{-3} \Big|$$



$$(x+3)(x^2+2x-8)$$

$$(x+3)(x-2)(x+4)$$

(Coefficients of the polynomial)

1	5	-2	-24
	-3	-6	24

1	2	-8
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$$\underline{-2} \times \underline{4} = -8$$

$$\underline{-2} + \underline{4} = 2$$

# Homework

② a)  $x^3 - 4x^2 + x + 6 = 0$        $x = -1$  is a root

$$(-1)^3 - 4(-1)^2 + (-1) + 6 = 0$$

$$-1 - 4 - 1 + 6 = 0$$

$$0 = 0$$

③ a)  $(x^3 - x^2 - 14x + 24) \div (x - 2)$

$$\begin{array}{r|rrrr} 2 & 1 & -1 & -14 & 24 \\ & & 2 & 2 & -24 \\ \hline & 1 & 1 & -12 & \end{array}$$

$$(x-2)(x^2 + x - 12)$$

$$(x-2)(x+4)(x-3)$$



Types of polynomials:

1 term  $\rightarrow$  monomial

2 terms  $\rightarrow$  binomial

3 terms  $\rightarrow$  trinomial

4 or more  $\rightarrow$  polynomial

Find the product:

$$(x+2)(2x^2+3x-4)$$

coefficients  
2, 3

$$\underline{2x^3} + \underline{3x^2} - \underline{4x} + \underline{4x^2} + \underline{6x} - 8$$

constant term  
-4

$$\boxed{2x^3 + 7x^2 + 2x - 8}$$

Factor:

$$\underline{2x^2} + \underline{7x} + \underline{6}$$

$$\begin{array}{l} \underline{3} + \underline{4} = 7 \\ \underline{3} \times \underline{4} = 12 \end{array}$$

$$(x+3)(x+4)$$

$$(2x+3)(x+2)$$

Solve:

$$\underline{2x^2} + \underline{7x} + \underline{6} = 0 \quad \begin{array}{l} \underline{3} + \underline{4} = 7 \\ \underline{3} \times \underline{4} = 12 \end{array}$$

$$(x + \underline{3})(x + \underline{4}) = 0$$

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

$$2x+3=0 \quad | \quad x+2=0$$

$$2x = -3$$

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

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

Solve for  $y$ 

$$-5y + 8 \geq y - 7$$

$$-5y - y \geq -7 - 8$$

$$\frac{-6y}{-6} \geq \frac{-15}{-6}$$

$$y \leq \frac{5}{2}$$

$$-5y + 8 \geq y - 7$$

$$8 + 7 \geq y + 5y$$

$$\frac{15}{6} \geq \frac{6y}{6}$$

$$\frac{5}{2} \geq y$$

$$x^4 + \underline{6}x^2 + \underline{8} = 0$$

$$(x^2 + 2)(x^2 + 4) = 0$$

$$\begin{array}{l|l} \cancel{x^2 + 2 = 0} & \cancel{x^2 + 4 = 0} \\ \cancel{x^2 = -2} & \cancel{x^2 = -4} \end{array}$$

$$\begin{array}{r} \underline{2} + \underline{4} = \underline{6} \\ \underline{2} \times \underline{4} = \underline{8} \end{array}$$

$$\begin{array}{r} 8 \\ 1 \times 8 \\ \textcircled{2 \times 4} \end{array}$$

$$2x \text{ } \textcircled{-3} \geq \textcircled{5x} + 9$$

$$2x - 5x \geq 9 + 3$$

$$\frac{-3x}{-3} \geq \frac{12}{-3}$$

$$x \leq -4$$

$$\textcircled{2x} - 3 \geq 5x \textcircled{+9}$$

$$-3 - 9 \geq 5x - 2x$$

$$\frac{-12}{3} \geq \frac{3x}{3}$$

$$-4 \geq x$$

$$x \leq -4$$

Solve for  $x$ :

$$2x^2 - 7x + 3 = 0$$

$$(x - \frac{1}{2})(x - 6) = 0$$

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

$$\begin{array}{l|l} 2x - 1 = 0 & x - 3 = 0 \\ 2x = 1 & x = 3 \\ x = \frac{1}{2} & \end{array}$$

$$\begin{array}{r} -1 + -6 = -7 \\ -1 \times -6 = 6 \end{array}$$

$$\begin{array}{r} 6 \\ -1 \ x - 6 \\ -2 \ x - 3 \end{array}$$

⑭

$$\underline{3}x^4 - 11x^2 - \underline{20}$$

$$\underline{-15} + \underline{4} = -11$$

$$\underline{-15} \times \underline{4} = \underline{-60}$$

$$\left(x^2 - \frac{15}{3}\right) \left(x^2 - \frac{4}{3}\right)$$

$$(x^2 - 5)(3x^2 - 4)$$

## ANSWERS

## Factoring All Polynomials

- |                              |                          |  |
|------------------------------|--------------------------|--|
| 1. $(3x+2)(3x-2)$            | 2. $(x+4)(x^2-4x+16)$    | 3. $50(2x+1)(2x-1)$                      |
| 4. $7x(x+1)(x+1)$            | 5. Prime                 | 6. $3(x^2+27)$                           |
| 7. $(2x-3)(x+1)$             | 8. $(x+5)(x-2)$          | 9. $(x+4)(x+4)$                          |
| 10. $(2x-5)(2x-5)$           | 11. $(x-2)(2x-1)$        | 12. $(3x+4)(x-5)$                        |
| 13. $(x^2-5)(x-3)$           | 14. $(2x+7)(2x-7)$       | 15. $(3x^2+4)(x^2-5)$                    |
| 16. $(x-9)(x-9)$             | 17. $(4x+9)(4x-9)$       | 18. $(x^2+2)(2x-3)$                      |
| 19. $(2x-3y)(4x^2+6xy+9y^2)$ | 20. $(x^2-3)(x+1)(x-1)$  | 21. $6ab(2x^2+ax^3-5b^2)$                |
| 22. $5a(a-5)$                | 23. $3a^3bm(ab-25m^3)$   | 24. $3(x+4)(x-4)$                        |
| 25. $8(x-2)(x^2+2x+4)$       | 26. $(x+6)(x-3)$         | 27. $50(2x+1)(2x-1)$                     |
| 28. $(6x^2+1)(3x+5)$         | 29. $3(x+2)(x^2-2x+4)$   | 30. $2(5x^2-1)(x-2)$                     |
| 31. $(x-7)(5x+3)$            | 32. $(2x+9)(2x+1)$       | 33. $5(x^2+5)(3x-5)$                     |
| 34. $(x+7)(x+8)$             | 35. $7x(2x+1)(2x-1)$     | 36. $(6x+1)(36x^2-6x+1)$                 |
| 37. $(2x-7)(6x-1)$           | 38. $3(2x+7)$            | 39. $(2x^2y+3z)(2x^2y-3z)(4x^4y^2+9z^2)$ |
| 40. $(9x-1)(2x^2+3)$         | 41. $4(2x-1)(4x^2+2x+1)$ | 42. $(4x-5)(2x+5)$                       |
| 43. $(x+9)(x-4)$             | 44. $2(x+6)(x+4)$        |  |