Ex # 2.6

Q.No.1

use Synthetic division to find the Quotient and the remainder, when

i $(x^2+7x-1) \div (x+1)$

$(x^2+7x-1) \div (x+1)$

As $x+1 = x-(-1)$, so $a=-1$

Now, write the co-efficient of x from divided in a row and $a=-1$ on the left side.

	1	7	-1
-1	↓	-1	-6
	1	6	-7

Quotient = $Qx = x+6$ and remainder = -7

ii $(4x^2-5x+15) \div (x+3)$

$(4x^2-5x+15) \div (x+3)$

As $x+3 = x-(-3)$ so, $a=-3$

Now, write the co-efficient of x from divided in a row and $a=-3$ on the left side.

	4	0	-5	15
-3	↓	-12	36	-93
	4	-12	31	-78

Quotient = $Qx = 4x^2-12x+31$

Remainder = -78

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iii

$(x^3+x^2-3x+2) \div (x-2)$

$(x^3+x^2-3x+2) \div (x-2)$

As $x-2 = x-(2)$ so $a = 2$

Now, write the co-efficients of x from dividend in a row and $a = 2$ on the left side.

	1	1	-3	2
2	↓	2	6	6
	1	3	3	8

Quotient $= Q(x) = x^2+3x+3$

Remainder $= 8$

Q. No. 2

Find the value of h using synthetic division, if

i 3 is the zero of polynomial $2x^3-3hx^2+9$

$P(x) = 2x^3-3hx^2+9$ and 3 is it's root.

	2	-3h	0	9
3	↓	6	3(6-3h)	9(6-3h)
	2	(6-3h)	3(6-3h)	9+9(6-3h)

Quotient $= Q(x) = 2x^2+(6-3h)x+3(6-3h)$

Remainder $= 9+9(6-3h)$

If "3" is zero of given polynomial.

So, $9+9(6-3h) = 0$

$9+54-27h = 0$

$63-27h = 0$

$h = \frac{63}{27}$

$h = 7/3$

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ii. 1 is the zero of polynomial $x^3 - 2hx^2 + 11$

$P(x) = x^3 - 2hx^2 + 11$

	1	$-2h$	0	11
1	↓	1	$(1-2h)$	$(1-2h)$
	1	$(1-2h)$	$(1-2h)$	$11+(1-2h)$

Quotient $= Q(x) = x^2 + (1-2h)x + (1-2h)$

Remainder $= 11 + (1-2h)$

As 1 is the zero of given polynomial

So $R = 11 + (1-2h) = 0$

$11 + 1 - 2h = 0$

$12 - 2h = 0$

$-2h = -12$

$h = 6$

iii. -1 is the zero of polynomial $2x^3 + 5hx - 23$

$P(x) = 2x^3 + 5hx - 23$

	2	0	$5h$	-23
-1	↓	-2	2	$-(5h+2)$
	2	-2	$(5h+2)$	$-23-(5h+2)$

Quotient $= Q(x) = 2x^2 - 2x + (5h+2)$

Remainder $= -23-(5h+2)$

As -1 is the zero of polynomial.

So,

$R = -23-(5h+2) = 0$

$-23 - 5h - 2 = 0$

$-25 - 5h = 0$

$-5h = 25$

$h = -5$

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Q.No.3

Use synthetic division to find the values of l and m. if

i $(x+3)$ and $(x-2)$ are the factors of polynomial

$$x^3+4x^2+2lx+m$$

$$P(x) = x^3+4x^2+2lx+m$$

and -3 and 2 are the roots.

For $x=-3$

	1	4	$2l$	m
-3	↓	-3	-3	$-3(2l-3)$
	1	1	$(2l-3)$	$m-3(2l-3)$

Quotient $= Q(x) = x^2 + x + (2l-3)$

Remainder $= m-3(2l-3)$

As $(x+3)$ is the factor of given polynomial

So, $m-3(2l-3)=0$

$m-6l+9=0$ — (i)

For $x=2$

	1	4	$2l$	m
2	↓	2	12	$2(2l+12)$
	1	6	$(2l+12)$	$m+2(2l+12)$

Quotient $= Q(x) = x^2+6x+2l+12$

Remainder $= m+2(2l+12)$

As $(x-2)$ is the factor. So,

$$m+2(2l+12)=0$$

$$m+4l+24=0 \rightarrow (ii)$$

Subtract (i) and (ii)

$$m-6l+9=0$$
$$-m\ \pm 4l\ \pm 24=0$$
$$-10l-15=0$$

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$-10l = 15$

$l = \frac{15}{-10}$

$l = -\frac{3}{2}$ put in (i)

$m - 6\left(\frac{-3}{2}\right) + 9 = 0$

$m + 9 + 9 = 0$

$m = -18$

So, $l = -\frac{3}{2}$, $m = -18$

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ii $(x-1)$ and $(x+1)$ are the factors of polynomial

$x^3 - 3lx^2 + 2mx + 6$

$P(x) = x^3 - 3lx^2 + 2mx + 6$

As 1 and -1 are the roots

For $a = 1$

	1	$-3l$	$2m$	6
1	↓	1	$(1-3l)$	$2m+(1-3l)$
	1	$(1-3l)$	$2m+(1-3l)$	$6+2m+(1-3l)$

Quotient $= Q(x) = x^2 + (1-3l)x + 2m + (1-3l)$

Remainder $= 6 + 2m + (1-3l)$

As $(x-1)$ is the factor of polynomial.

$6 + 2m + (1-3l) = 0$

$6 + 2m + 1 - 3l = 0$

$7 + 2m - 3l = 0$ — (i)

For $a = -1$

	1	$-3l$	$2m$	6
-1	↓	-1	$-(-3l-1)$	$-(2m-(-3l-1))$
	1	$(-3l-1)$	$2m-(-3l-1)$	$6-(2m-(-3l-1))$

Quotient $= Q(x) = x^2 - (3l+1)x + 2m + (3l+1)$

Remainder $= 6 - (2m - (-3l-1))$

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As $(x+1)$ is the factor:-

$$6-[2m-(-3l-1)]=0$$

$$6-[2m+3l+1]=0$$

$$6-2m-3l-1=0$$

$$5-2m-3l=0 \quad \text{—(ii)}$$

Add (i) and (ii)

$$7+2m-3l=0$$
$$5-2m-3l=0$$

$$12-6l=0$$

$$-6l=-12$$

$l=2$ put in (i)

$$7+2m-3(2)=0$$

$$7+2m-6=0$$

$$1+2m=0$$

$$2m=-1$$

$$m=-1/2$$

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So, $l=2$, $m=-1/2$

Q.No.4

Solve by using Synthetic division, if

(i) 2 is the root of the equation $x^3-28x+48=0$

$P(x)=x^3-28x+48$ and 2 is root.

So,

	1	0	-28	48
2	↓	2	4	-48
	1	2	-24	0

Quotient $=Q(x)=x^2+2x-24$

Remainder $=0$

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The depressed equation is

$$x^2+2x-24=0$$

$$x^2+6x-4x-24=0$$

$$x(x+6)-4(x+6)=0$$

$$(x-4)(x+6)=0$$

$x-4=0$ $\qquad$ $x+6=0$

$x=4$ $\qquad$ $x=-6$

So, the roots are $2, 4$ & -6

(iii) 3 is the root of the equation

$$2x^3-3x^2-11x+6=0$$

$P(x)=2x^3-3x^2-11x+6$ and 3 is the root.

	2	−3	−11	6
3	↓	6	9	−6
	2	3	−2	0

Quotient $= Q(x) = 2x^2+3x-2$

Remainder $= 0$

The depressed Equation is.

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

$$2x^2+4x-x-2=0$$

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

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

$2x-1=0$ $\qquad$ $x+2=0$

$2x=1$ $\qquad$ $x=-2$

$x=1/2$

So roots are, $3, 1/2$ and -2.

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iii) -1 is the roots of the equation

$$4x^3 - x^2 - 11x - 6 = 0$$

$P(x) = 4x^3 - x^2 - 11x - 6$ and -1 is root.

	4	-1	-11	-6
-1	↓	-4	5	6
	4	-5	-6	0

Quotient $= Q(x) = 4x^2 - 5x - 6$

Remainder $= 0$

The depressed Equation:-

$$4x^2 - 5x - 6 = 0$$

$$4x^2 - 8x + 3x - 6 = 0$$

$$4x(x-2) + 3(x-2) = 0$$

$$(4x+3)(x-2) = 0$$

$4x + 3 = 0$ $\qquad$ $x - 2 = 0$

$4x = -3$ $\qquad$ $x = 2$

$x = \frac{-3}{4}$

So, the roots are $-1, \frac{-3}{4}, 2$

Q.No.5

Solve by using Synthetic division, if

(i) 1 and 3 are roots of equation $x^4 - 10x^2 + 9 = 0$

$P(x) = x^4 - 10x^2 + 9$ and 1 & 3 are roots

	1	0	-10	0	9
1	↓	1	1	-9	-9
	1	1	-9	-9	0
3	↓	3	12	9	
	1	4	3	0	

Quotient $= Q(x) = x^2 + 4x + 3$

Remainder $= 0$

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The depressed equation is

$$x^2+4x+3=0$$
$$x^2+3x+x+3=0$$
$$x(x+3)+1(x+3)=0$$
$$(x+1)(x+3)=0$$

$x+1=0$ $\qquad$ $x+3=0$

$x=-1$ $\qquad$ $x=-3$

So the roots $1, 3, -1, -3$.

ii 3 and -4 are the roots of the equation.

$$x^4+2x^3-13x^2-14x+24=0$$

$P(x)=x^4+2x^3-13x^2-14x+24$ and $3, -4$ are roots.

	1	2	−13	−14	24
3	↓	3	15	6	−24
	1	5	2	−8	0
−4	↓	−4	−4	8	
	1	1	−2	0	

Quotient $=Q(x)=x^2+x-2$ and Remainder $=0$

The depressed equation is,

$$x^2+x-2=0$$
$$x^2+2x-x-2=0$$
$$x(x+2)-1(x+2)=0$$
$$(x-1)(x+2)=0$$

$x-1=0$ $\qquad$ $x+2=0$

$x=1$ $\qquad$ $x=-2$

So, the roots are $3, -4, 1, -2$

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