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# Class 11 Mathematics

# Chapter 7

# Exercise 7.4

# Notes

National Book Foundation

$$\left(\frac{2.01}{2}\right)^{1/3} = \frac{2+2(2.01)}{2.01+4} = \frac{2+4.02}{6.01}$$

$$= \frac{6.02}{6.01} = 1.0016 \text{ or } \frac{602}{601} \text{ Ans}$$

# Exercise 7.4.

## Topic: Cyclicity of Number.

Cyclicity of a number is a technique of Pridiction of the unit digit of any number having any exponent (when exponent is quite larger).

Cyclicity of a number is a number where the exponent repeats the unit number same as the number which we are solving the exponent.

### Cyclicity 2.

$$\left.\begin{aligned} 2^1 &= 2 \\ 2^2 &= 4 \\ 2^3 &= 8 \\ 2^4 &= 16 \end{aligned}\right]$$

$2^5 = 32$

$2^6 = 64$
$2^7 = 128$
$2^8 = 256$

cyclicity of 2 is $\boxed{4}$

$2^9 = 512$
$2^{10} = 1024$
$2^{11} = 2048$
$2^{12} = 4096$

$3^1 = 3$
$3^2 = 9$
$3^3 = 27$
$3^4 = 81$

$3^5 = 243$
$3^6 = 729$
$3^7 = 2187$
$3^8 = 6561$

cycliaty of 3 is $\boxed{4}$

$3^9 = 19683$
$3^{10} = 59049$
$3^{11} = 177147$
$3^{12} = 531441$

## Cyclicity of 1 : $\boxed{1}$

$1^1 = 1$ $\quad$ $1^3 = 1$

$1^2 = 1$ $\quad$ $1^4 = 1$

## Cyclicity of 4 : $\boxed{2}$

$4^1 = 4$ $\quad$ $4^3 = 64$ — unit digit same as 1

$4^2 = 16$ $\quad$ $4^4 = 256$

## Cyclicity of 5 : $\boxed{1}$

$5^1 = 5$ $\quad$ $5^3 = 125$

$5^2 = 25$ $\quad$ $5^4 = 625$

## Cyclicity of 8 : $\boxed{4}$

$8^1 = 8$

$8^2 = 64$ $\quad$ $8^4 = 4096$

$8^3 = 512$ $\quad$ $8^5 = 32768$

## Cyclicity of 9 $\boxed{2}$

$9^1 = 9$ $\quad$ $9^3 = 729$

$9^2 = 81$ $\quad$ $9^4 = 6561$

## Cyclicity of 6 $\boxed{1}$

$6^1 = 6$ $\quad$ $6^3 = 216$

$6^2 = 36$ $\quad$ $6^4 = 1296$

## Cyclicity of 7: $\boxed{4}$

$7^1 = 7$ $\quad$ $7^3 = 343$ $\quad$ $7^5 = 16807$

$7^2 = 49$ $\quad$ $7^4 = 2401$

| Digit | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Cyclicity | 1 | 1 | 4 | 4 | 2 |
| | 5 | 6 | 7 | 8 | 9 |

# Cyclicity of Table of Digits 0-9.

| Digit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cyclicity | 1 | 1 | 4 | 4 | 2 | 1 | 1 | 4 | 4 | 2 |

## Example :- Find unit Place digit of $(64)^{20}$

Sol:- we have to find the unit place digit of $(64)^{20}$

i) unit digit of 64 is 4

(ii) Cyclicity of 4 is 2

(iii) Dividing 20 by 2

$$2\overline{)20}^{\,10}$$
$$\underline{20}$$
$$0$$

Remainder is 0

it means unit place digit is 6, of $(64)^{20}$

As remainder is '0' the unit digit will be the last digit of where cycle end

## Procedure of Finding the unit place digit:

To find the unit place digit of $(ab)^n$, n is large.

**Step 1**

First allocate the unit digit of given number ∴ b

**Step 2:** Allocate the cyclicity of unit digit ∴ cyclicity of b is P,

**Step 3:** Divide the index "n" by "p" and find the remainder. If remainder is "0" then consider the unit digit where cycle ends.

**Example: Find unit digit of $(8)^{51}$**

1) Unit place digit of 8 is 8
2) Cyclicity of 8 is 4
3) Dividing '51' by '4'

$$\begin{array}{r} 12 \\ 4\overline{)51} \\ \underline{4\phantom{1}} \\ 11 \\ \underline{8} \\ 3 \end{array}$$

$3 \rightarrow (8)^3 = 512 \rightarrow$ unit digit of $(8)^{51}$

As Remainder is 3 so unit place

**Example Find digit of $(17)^{109}$**

(i) unit place digit of 17 is 7
(ii) cyclicity of 7 is 4
(iii) dividing 109 by 4.

$$\begin{array}{r} 27 \\ 4\overline{)109} \\ \underline{8\phantom{9}} \\ 29 \\ \underline{28} \\ 1 \end{array}$$

As remainder of is 1 so the unit digit of $(17)^{109}$ is $\boxed{7}$

Qno1 (i) $(27)^{304}$

(i) Unit digit of 27 = 7
(ii) Cyclicity of 7 = 4
(iii) Divide 304 by 4

$$
\begin{array}{r|l}
 & 76 \\
\hline
4 & 304 \\
 & 28 \\
\hline
 & 24 \\
 & 24 \\
\hline
 & 0 \text{ — Remainder}
\end{array}
$$

$(27)^{304}$

$(27)^{76\times4}$

$(20+7)^{76+4+0}$

$= 7^0$

$= \boxed{1}$

As Remainder is "0" which shows the cycle is end for "7". So $7^4$ =
2401 ⟹ which has unit digit (1).
Hence $(27)^{304}$ has unit digit $\boxed{1}$ ✓

(ii) $108^{33}$

~~(i) unit place digit of 54 is 4~~
~~(ii) Cyclicity of 4 is 2~~
~~(iii) divide 203 by 2~~

$$
\begin{array}{r|l}
 & 101 \\
\hline
2 & 203 \\
 & 20 \\
\hline
 & 3 \\
 & 2 \\
\hline
 & 1
\end{array}
$$

~~As Remainder is $\boxed{1}$ so unit digit is $\boxed{4}$~~

As period of 8 is 4 at unit place.

$= (100+8)^{33}$

$= (100+8)^{8\times4+1}$ = unit place digit is $8^1 = 8$

(iv) $(503)^{43}$

① Unit place digit is 3 of 503

② Cyclicity of 3, is 4

③ Divide 43 by 4

$$4\overline{)43}^{\,10}$$
$$\underline{40}$$
$$3$$

As Remainder is 3 so $(3)^3 = 27$ so unit digit is 7 of $(503)^{43}$

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## Concept Remainder

$\frac{10}{2} = 2\overline{)10}^{\,5}$, $\underline{10}$, 0 — (Remainder)

$\frac{11}{2}$ $2\overline{)11}^{\,5}$, $\underline{10}$, 1

when a number is divisible by 2 we have remainders 0, 1

When $\frac{19}{5}$ $5\overline{)19}^{\,4}$, $\underline{20}$, $-1$ $5\overline{)19}^{\,3}$, $\underline{15}$, 4

Two possibilities

-ve remainder + divisor = +ve Remainder

## Tricks to Find Remainder

+ve Remainder

$\frac{19}{5} = 4$

-ve Remainder

$\frac{19}{5} = -1$

-ve remainder + divisor = +ve remainder

# Addition and Product Rule of Remainder.

- $\frac{43+38}{2} \Rightarrow R(43)+R(38) = 1+0 = 1$ Ans

- $\frac{89+120+52+79}{11} \Rightarrow 1+(-1)+(-3)+(2) = -1$

-ve Remainder + divisor = +ve remainder

$(-1)+11 = 10$ Ans

Product rule:

- $\frac{37 \times 43}{7} = 2 \times 1 = 2$ Ans

- $\frac{(51)^{26}}{13} = \left(\frac{52-1}{13}\right)^{26} = (-1)^{26} = 1$

$-1+13 = \boxed{12}$

- $\frac{(49)^{78}}{10} = \frac{(50-1)^{78}}{10} = (-1)^{78} = \boxed{1}$



Q no 2:

(a) $(94)^{205}$ is divided by 31

$(94)^{205} = (93+1)^{205} = \binom{205}{0}(93)^{205}(1) + \binom{205}{1}(93)^{204}(1)$

$+ \cdots\cdots\cdots + \binom{205}{3}(93)^{0}(1)^{205}$

$\Rightarrow \frac{(94)^{205}}{31} = \frac{\binom{205}{0}(93)^{205} + \binom{205}{1}(93)^{204} + \cdots + (1)^{205}}{31}$

As on R.H.S Every Term is divisible by 31 except last term which is $(1)^{205} = 1$ so remainder is 1

OR by Product.

Alternative $= \frac{(94)^{204}}{31} = \frac{94 \times 94 \times 94 \times \ldots \times 94\,(204 \text{ times})}{31}$

$= (1)(1)(1) \ldots (1)(205$

$= 1$ Answer

(b)

$(8)^{205}$ is $\div$ by 48

$\frac{(8)^{205}}{48} = \frac{(2^3)^{205}}{48} = \frac{2^{615}}{48} = \frac{2^4 \cdot 2^{611}}{48} = \frac{16 \cdot 2^{611}}{48}$

$= \frac{2^{611}}{3}$ — (1)

$\frac{2 \cdot 2^{610}}{3} = \frac{2(2^2)^{305}}{3} = \frac{2(4)^{305}}{3} = 2\left(\frac{3+1}{3}\right)^{305}$

$= 2\left[\frac{\binom{305}{0}(3)^{305}(1)^0 + \binom{305}{1}(3)^{304}(1) + \ldots + \binom{305}{305}(3)^0(1)^{305}}{3}\right]$

$= 2$ (Every term is divisible by 3 except last)

$(1)^{305} = 1$

$2(1) = 2$ Remainder Ans

By product

$\frac{2^{611}}{3} = \frac{2 \times 2 \times \ldots \times 611 \text{ times}}{3}$

$= (-1)(-1)(-1) \ldots 611$ times

$= (-1)^{611} = -1+3 = \boxed{2}$ Ans

Example -

$\frac{(80)^{7218}}{9}$

$= \frac{(80)(80)(80) \cdots\cdots (80)}{9}$ 7218 times

$= (-1)(-1)(-1) \cdots\cdots (-1)$ 7218 times

$= (-1)^{7218} = \boxed{1}$ Answer

Q3

$\frac{2^{510}}{31}$ is $\frac{K}{31}$

Sol $\frac{(2)^{510}}{31} = \frac{(2^5)^{102}}{31} = \frac{(32)^{102}}{31}$

$= \frac{(32)(32)(32) \cdots\cdots (32)}{31}$ 102 times

$= \frac{2^{510}}{31} = (1)(1)(1) \cdots\cdots (1)$ 102 times

$= (1)^{102} = \boxed{1}$

$\boxed{K = 1}$ A

OR

By binomial

$\frac{(32)^{102}}{31} = \frac{(31+1)^{102}}{31} = \binom{102}{0}(31)^{102}(1)^0 + \cdots\cdots$

By Binomial. $\frac{2^{510}}{31}$ OR $= \frac{(2^5)^{102}}{31} = \frac{(32)^{102}}{31}$

$\frac{(32)^{102}}{31} = \frac{(31+1)^{102}}{31}$

$$= \frac{\binom{102}{0}(31)^{102}(1)^0 + \cdots + \binom{102}{102}(31)^0(1)^{102}}{31}$$

$\frac{(32)^{102}}{31}$ = Every term is divisible by 31 except last $\frac{1}{31} = \frac{K}{31} \Rightarrow \boxed{K=1}$

Q4
(a)

$15^8$

Sol

$$(10+5)^8 = \binom{8}{0}(10)^8(5)^0 + \binom{8}{1}(10)^7(5)^1 + \binom{8}{2}(10)^6(5)^2$$
$$+ \binom{8}{3}(10)^5(5)^3 + \binom{8}{4}(10)^4(5)^4 + \binom{8}{5}(10)^3(5)^5$$
$$+ \binom{8}{6}(10)^2(5)^6 + \binom{8}{7}(10)^1(5)^7 + \binom{8}{8}(10)^0(5)^8$$

$$= 10^2\left[\binom{8}{0}(10)^6 + \binom{8}{1}10^5(5) + \cdots + \binom{8}{6}(5)^6\right] +$$
$$\binom{8}{7}(10)(5)^7 + \binom{8}{8}(5)^8$$

$$= 100(\underline{m}) + \binom{8}{7}10(5)^7 + \binom{8}{8}5^8$$

$$= 100m + 8(10)(78125) + 390625$$

= (Last two digits are always zero) + 6640625

= So Resultant have last two digits 25

Unit digit of $(15)^8$ is 5

last two digits of $(15)^8$ is 25

(b)

$37^7$

Sol: $(30+7)^7$

$(37)^7 = (30+7)^7 = \binom{7}{0}(30)^7(7)^0 + \binom{7}{1}(30)^6(7)^1$

$+\binom{7}{2}(30)^5(7)^2 + \binom{7}{3}(30)^4(7)^3 + \binom{7}{4}(30)^3(7)^4$

$+\binom{7}{5}(30)^2(7)^5 + \binom{7}{6}(30)^1(7)^6 + \binom{7}{7}(30)^0(7)^7$

= Taking $(30)^2$ common from First 6 terms

$= (30)^2 [\_\_\_\_\_\_] + \binom{7}{6}(30)^1(7)^6 + (7)^7$

$= 900 (\_\_\_\_\_\_) + 25529833$

= last two digits 33 Ans

Q4 (c)

for $(29)^{10}$

$(29)^{10} = (20+9)^{10} = \binom{10}{0}(20)^{10}(9)^0 + \binom{10}{1}(20)^9(9)^1$

$+ \binom{10}{2}(20)^8(9)^2 + \binom{10}{3}(20)^7(9)^3 + \binom{10}{4}(20)^6(9)^4$

$+ \binom{10}{5}(20)^5(9)^5 + \binom{10}{6}(20)^4(9)^6 + \binom{10}{7}(20)^3(9)^7$

$+ \binom{10}{8}(20)^2(9)^8 + \binom{10}{9}(20)^1(9)^9 + \binom{10}{10}(20)^0(9)^{10}$

$= (20)^2 \left[\boxed{\quad}\right] + \binom{10}{9}(20)^1(9)^9 + (9)^{10}$

$\cancel{= (20)^2 [\quad] + 809}$

(Having last digits 00) + 80970882201

$= \boxed{01}$ Answer

Q5

(a) $(98)^{50} + (100)^{50}$ or $(102)^{50}$

$(102)^{50} = (100+2)^{50} = \binom{50}{0}(100)^{50}(2)^0 +$

$\binom{50}{1}(100)^{49}(2)^1 + \dots + \binom{50}{50}(100)^0(2)^{50}$

$(102)^{50} = (100)^{50} + 50\cdot(100)^{49}\cdot 2 + \dots + 2^{50}$ —— (i)

$(98)^{50} = (100-2)^{50} = \binom{50}{0}(100)^{50}(-2)^0 + \binom{50}{1}(100)^{49}(-2)^1$
$+ \dots + (-2)^{50}$ —— (ii)

Subtracting (i) and (ii)

$(102)^{50} - (98)^{50} = 50\cdot(100)^{49}\cdot 2 + 50(100)^{49}(2) \dots\dots$

$= 100(100)^{49} + 100(100)^{49}$

$(102)^{50} - (98)^{50} = 2(100)^{50} + \dots > (100)^{50}$

$(102)^{50} - (98)^{50} > (100)^{50}$

$(102)^{50} > (100)^{50} + (98)^{50}$ Hence proved.

(b)

$47^{30} + 50^{30}$ or $53^{30}$

$(53)^{30} = (50+3)^{30} = \binom{30}{0}(50)^{30}(3)^0 + \binom{30}{1}(50)^{29}(3)^1$
$+ \binom{30}{2}(50)^{28}(3)^2 + \dots + \binom{30}{30}(50)^0(3)^{30}$

$(53)^{30} = (50)^{30} + (30)(50)^{29}(3) + (435)(50)^{28}(3)^2$
$+ \dots + (3)^{30}$ —— (i)

$(47)^{30} = (50-3)^{30} = \binom{30}{0}(50)^{30}(-3)^0 + \binom{30}{1}(50)^{29}(-3)^1$
$+ \binom{30}{2}(50)^{28}(-3)^2 + \dots + \binom{30}{30}(50)^0(-3)^{30}$

$(47)^{30} = (50)^{30} - (30)(50)^{29}(3) + (435)(50)^{28}(3)^2 +$
$\dots + (3)^{30}$ —— (ii)

$(53)^{30}-(47)^{30} = \cancel{(50)^{3}}+(30)(50)^{29}(3)+(435)$
$+(435)\cancel{(50)^{28}}(3)^2+\cdots+(3)^{30}$ —

$\cancel{(50)^{30}}+(30)(50)^{29}(3)-435\cancel{(50)^{28}}(3)^2+\cdots-(3)^{30}$

$= (90)(50)^{29}+(90)(50)^{29}+\cdots$ —

$(53)^{30}-(47)^{30} = (180)(50)^{29}+\cdots$

$(53)^{30}-(47)^{30} = (130+50)(50)^{29}+\cdots$

$(53)^{30}-(47)^{30} = 50\cdot 50^{29}+(50)^{29}(130)+\cdots$

$(53)^{30}-(47)^{30} = (50)^{30}+(50)^{29}(130)+\cdots$

$(53)^{30}-(47)^{3} = (50)^{30}+(50)^{29}(130)+\cdots > (50)^{30}$

$(53)^{30} > (50)^{30}+(47)^{30}$ A —



6

$12^{15}+8^{15}$ is divisible by 10.

Sol

$(12)^{15}=(10+2)^{15}=\binom{15}{0}(10)^{15}(2)^0+\binom{15}{1}(10)^{14}(2)^1+$
$\binom{15}{2}(10)^{13}(2)^2+\cdots+\binom{15}{15}(10)^0(2)^{15}$

$(12)^{15}=10^{15}+15(10)^{14}(2)+105(10)^{13}(2)^2+\cdots$
$\cdots+(2)^{15}$ — (1)

$(8)^{15}=(10-2)^{15}=\binom{15}{0}(10)^{15}(-2)^0+\binom{15}{1}(10)^{14}(-2)^1$

$+\binom{15}{2}(10)^{13}(-2)^2 + \cdots + \binom{15}{15}(10)^0(-2)^{15}$

$(8)^{15} = (10)^{15} - 15(10)^{14}(2) + 105(10)^{13}(2)^2 + \cdots - (2)^{15}$ — (ii)

Adding (i) & (ii)

$(12)^{15} + (8)^{15} = 2(10)^{15} + 2(105(10)^{14}(2)^2) + \cdots$
$\cdots + 2\left(\binom{15}{14}(10)^1(-2)^{14}\right)$

$= 2(\text{———})$ as given R.H.S is multiple of 2 so divisible by 2

Q7

Show $22^{25} + 18^{25}$ is divisible by 20.

$(22)^{25} = (20+2)^{25} = \binom{25}{0}(20)^{25}(2)^0 + \binom{25}{1}(20)^{24}(2)^1$
$+ \cdots + \binom{25}{24}(20)^1(2)^{24} + \binom{25}{25}(20)^0(2)^{25}$ — (i)

$(18)^{25} = (20-2)^{25} = \binom{25}{0}(20)^{25}(-2)^0 + \binom{25}{1}(20)^{24}(-2)^1$

$+ \cdots + \binom{25}{24}(20)^1(-2)^{24} + \binom{25}{25}(20)^0(2)^{25}$ — (ii)

Adding (i) and (ii)

$(22)^{25} + (18)^{25} = 2(20)^{25} + 2\binom{25}{2}(20)^{23}(2)^2 +$
$\cdots + 2\binom{25}{24}(20)^1(2)^{24}$

$= 20[\ \text{"}\ \ \text{"}\ ] =$ AS R.H.S is multiple of 20 so divisible by 20

Q no 8

$5^{103}$ is divisible by 13

$$\frac{(5)^{103}}{13} = \frac{5 \cdot 5^{102}}{13} = \frac{5(5^2)^{51}}{13} = \frac{5(25)^{51}}{13}$$

$$5\left(\frac{26-1}{13}\right)^{51} = \frac{5}{13}\left(\binom{51}{0}(26)^{51}(-1)^0 + \cdots + \binom{51}{51}(26)^0(-1)^{51}\right)$$

$$= 5\left[\frac{\binom{51}{0}(26)^{51} + \_\_\_\_ +}{13}\right] + \frac{(-1)^{51}}{13}$$

⇒ As 13 divides the entire terms except last term which is $(-1)^{51}$ so Remainder is $5(-1)^{51} = -5$

⇒ −ve Remainder + divisor = +ve Remainder

$-5 + 13 = \boxed{8}$ Ans

Q 9

$(17)^{1717}$ is ÷ by 9.

$$\frac{(17)^{1717}}{9} = \frac{(18-1)^{1717}}{9}$$

$$\frac{(18-1)^{1717}}{9} = \frac{1}{9}\left[\binom{1717}{0}(18)^{1717}(-1)^0 + \binom{1717}{1}(18)^{1716}(-1)^1\right.$$

$$\left. + \cdots + \binom{1717}{1717}(18)^0(-1)^{1717}\right]$$

⇒ As we see entire values are divisible by 9 except last one

$= (-1)^{1717} \Rightarrow \frac{1}{9}(-1)^{1717} = (-1)^{1717} = -1$

$= -1 + 9 = \boxed{8}$ A By using Binomial

OR

By rule

$\frac{\binom{1717}{17}}{9} = \frac{(17)(17)(17) + \text{------} (17)(1717 \text{ times})}{9}$

$\Rightarrow (-1)(-1)(-1) \text{ ------ } (-1)$ 1717 times

$(-1)^{1717} = (-1) + 9 = \boxed{8}$ An

Q10

$(1 \cdot 1)^{10,000}$ or $1000$.

$(1 \cdot 1)^{10,000} = (1 + 0 \cdot 1)^{10,000} = \binom{10,000}{0}(1)^{10,000}(0 \cdot 1)^0$

$+ \binom{10,000}{1}(1)^{9999}(0 \cdot 1)^1 + \text{------} + (0 \cdot 1)^{10,000}$

$(1 \cdot 1)^{10,000} = 1 + (10,000)(0 \cdot 1) + \text{------} + (0 \cdot 1)^{10,000}$

$(1 \cdot 1)^{10,000} = 1 + 1000 + \cdots\cdots (0 \cdot 1)^{1000} > 1000$

2nd term is 1000 itself so

$(1 \cdot 1)^{10,000} > 1000$ A

~~For end~~

or second method on end

Q no 11. $9^{n+1}-8n-9$ is divisible by 64.

$$9^{n+1}-8n-9=(8+1)^{n+1}-8n-9$$

$$=\binom{n+1}{0}(8)^{n+1}(1)^0+\binom{n+1}{1}(8^n)(1)^1+\dots+\binom{n+1}{n-1}8^2$$

$$\binom{n+1}{n}8^1(1)^n+\binom{n+1}{n+1}8^0(1)^{n+1})-8n-9.$$

$$=\left(8^{n+1}+\binom{n+1}{1}8^n+\dots+\binom{n+1}{1}8+1\right)-8n-9$$

$$=8^{n+1}+\binom{n+1}{1}8^n+\cancel{8n}+\cancel{8}+\cancel{1}-\cancel{8n}-\cancel{9}.$$

$$=8^{n+1}+\binom{n+1}{1}8^n$$

$$=8^{n+1}+\binom{n+1}{1}8^n\dots+\binom{n+1}{n-1}8^2.$$

one of the term is divisible by 64

Q 12.

$(a-b)$ is factor of $a^n-b^n$.

$$(a^n-b^n)=(a-b+b)^n-b^n=((a-b)+b)^n-b^n$$

$$((a-b)+b)^n-b^n=\left[\binom{n}{0}(a-b)^n(b)^0+\binom{n}{1}(a-b)^{n-1}(b)^1\right.$$

$$+\binom{n}{2}(a-b)^{n-2}(b)^2+\dots+\binom{n}{n-1}(a-b)(b)^{n-1}$$

$$\left.+\binom{n}{n}(a-b)^0(b^n)\right]-b^n.$$

$$((a-b)+b)^n = (a-b)^n + \binom{n}{1}(a-b)^{n-1}b + \binom{n}{2}(a-b)^{n-2}b^2$$

$$+ \cdots + \binom{n}{n-1}(a-b)(b)^{n-1} + \cancel{b^n} - \cancel{b^n}.$$

$a^n - b^n =$ clearly every term has $(a-b)$ as a factor and is divisible by $a-b$

sol Q13 $6^{n+3} - 18n - 6$ is divisible by 6

$= 6^{n+3} - 6\cdot 3n - 6$

$= 6^{n+2}\cdot 6 - 6\cdot 3n - 6$

$= 6(6^{n+2} - 3n - 1)$ clearly 6 is the factor so terms are divisible by 6