



## CHEMISTRY ONLINE — TUITION —

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# PURE MATH ALGEBRA AND FUNCTION

Level & Board	EDEXCEL (A-LEVEL)
TOPIC:	BINOMIAL EXPANSION
PAPER TYPE:	SOLUTION - 3
TOTAL QUESTIONS	8
TOTAL MARKS	39

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**Q.1**

The binomial expansion for  $(3 - 2x)^{\frac{1}{2}}$ . Using the binomial theorem is:

$$(3 - 2x)^{\frac{1}{2}} = \sqrt{3} - \frac{1}{\sqrt{3}}x + \frac{1}{6\sqrt{3}}x^2 + \dots$$

Now,

Let's use the expansion to approximate  $\sqrt{2}$  by substituting  $x = \frac{1}{2}$

$$\begin{aligned} \left(3 - 2\left(\frac{1}{2}\right)\right)^{\frac{1}{2}} &= \sqrt{3} - \frac{1}{\sqrt{3}}\left(\frac{1}{2}\right) + \frac{1}{6\sqrt{3}}\left(\frac{1}{2}\right)^2 + \dots \\ \Rightarrow (2)^{\frac{1}{2}} &= \sqrt{3} - \frac{1}{2\sqrt{3}} + \frac{1}{24\sqrt{3}} \\ \sqrt{2} &\approx \sqrt{3} - \frac{1}{2\sqrt{3}} + \frac{1}{24\sqrt{3}} \end{aligned}$$

So, by using the binomial expansion, we have an approximation for  $\sqrt{2}$  in terms of  $\sqrt{3}$ .

**Q.2**

The binomial expansion for  $(1 + 2x)^{\frac{4}{3}}$ . Using the binomial theorem is:

$$(1 + 2x)^{\frac{4}{3}} = 1 + \frac{8}{3}x + \frac{16}{9}x^2 + \dots$$

Now,

Let's use this expansion to approximate

$$\sqrt[3]{10} \text{ by substituting } x = \frac{1}{2},$$

$$1 + 2\left(\frac{1}{2}\right)^{\frac{1}{3}} = 1 + \frac{8}{3}\left(\frac{1}{2}\right) + \frac{16}{9}\left(\frac{1}{2}\right)^2 + \dots$$

Simplify

$$(3)^{\frac{4}{3}} = 1 + \frac{4}{3} + \frac{4}{9}$$

$$\sqrt[3]{10} \approx 1 + \frac{4}{3} + \frac{4}{9}$$

So, By using the binomial expansion, we have an approximation for

$\sqrt[3]{10}$  as  $\frac{19}{9}$ .

### Q.3

The binomial expansion for  $(3 - 2x)^{\frac{1}{2}}$  using binomial theorem is:

$$(3 - 2x)^{\frac{1}{2}} = \sqrt{2} - \frac{3}{\sqrt{2}} \left(\frac{1}{3}\right) + \frac{9}{4\sqrt{2}} \left(\frac{1}{3}\right)^2 + \dots$$

Simplify:

$$\left(\frac{5}{3}\right)^{\frac{1}{2}} = \sqrt{2} - \frac{1}{\sqrt{2}} + \frac{1}{6\sqrt{2}}$$

$$\sqrt{5} \approx \sqrt{2} - \frac{1}{\sqrt{2}} + \frac{1}{6\sqrt{2}}$$

So,

by using the binomial expansion, we have an approximation for

$\sqrt{5}$  in terms of  $\sqrt{2}$ .

### Q.4

The binomial expansion for  $(1 - 4x)^{\frac{2}{3}}$  Using the binomial theorem is:

$$(1 - 4x)^{\frac{2}{3}} = 1 - \frac{8}{3}x + \frac{16}{9}x^2 + \dots$$

Now,

Let's use this expansion to approximate  $\sqrt[3]{2}$  by substituting  $x = \frac{1}{4}$

$$\left(1 - 4\left(\frac{1}{4}\right)\right)^{\frac{2}{3}} = 1 - \frac{8}{3}\left(\frac{1}{4}\right) + \left(\frac{16}{9}\right)\left(\frac{1}{4}\right)^2 + \dots$$

*Simplifying:*

$$\left(\frac{1}{2}\right)^{\frac{2}{3}} = 1 - \frac{1}{3} + \frac{1}{36}$$

$$\sqrt[3]{2} \approx 1 - \frac{1}{3} + \frac{1}{36}$$

*So, by using the binomial expansion we have an approximation for*

$\sqrt[3]{2}$  as  $\frac{35}{36}$ .

**Q.5**

*The binomial expansion for  $(5 + 2x)^{\frac{3}{2}}$  Using the binomial theorem is:*

$$(5 + 2x)^{\frac{3}{2}} = 125 + 75x + \frac{75}{2}x^2 + \dots$$

*Now,*

*let's use this expansion to approximate  $\sqrt{29}$  by substituting  $x = 2$*

$$(5 + 2(2))^{\frac{3}{2}} = 125 + 75(2) + \frac{75}{2}(2)^2 + \dots$$

*Simplifying:*

$$(29)^{\frac{1}{2}} = 125 + 150 + 150$$

$$\sqrt{29} \approx 425$$

*So, by using the binomial expansion we have an approximation for  $\sqrt{29}$  as 425.*

I am Sorry !!!!

**Q.6**

*The binomial expansion for  $(1 - 3x)^{\frac{4}{3}}$  Using the binomial theorem is:*

$$(1 - 3x)^{\frac{4}{3}} = 1 - 4x + \frac{18}{3}x^2 + \dots$$

*Now,*

Let's use this binomial expansion to approximate  $\sqrt[3]{\frac{1}{2}}$  by substituting  $x = \frac{1}{6}$

$$\left(1 - 3\left(\frac{1}{6}\right)\right)^{\frac{4}{3}} = 1 - 4\left(\frac{1}{6}\right) + \frac{18}{3}\left(\frac{1}{6}\right)^2 + \dots$$

Simplifying:

$$\left(\frac{1}{2}\right)^{\frac{1}{3}} = 1 - \frac{2}{3} + \frac{1}{18}$$

$$\sqrt[3]{\frac{1}{2}} \approx 1 - \frac{2}{3} + \frac{1}{18}$$

So, by using the binomial expansion, we have an approximation for

$$\sqrt[3]{\frac{1}{2}} \text{ as } \frac{17}{18}.$$

## Q.7

The binomial expansion for  $(3 + 2x)^{\frac{5}{2}}$  Using the binomial theorem is:

$$(3 + 2x)^{\frac{5}{2}} = 243 + 405x + 270x^2 + \dots$$

Now,

Let's use this expansion to approximate  $\sqrt{11}$  by substituting  $x = 4$

$$(3 + 2(4))^{\frac{5}{2}} = 243 + 405(4) + 270(4)^2 + \dots$$

Simplifying:

$$(11)^{\frac{1}{2}} = 243 + 1620 + 4320$$

$$\sqrt{11} \approx 6183$$

So, by using the binomial expansion, we have an approximation for

$$\sqrt{11} = 6183$$

I am Sorry !!!!

**Q.8**

The binormal expansion for  $(1 - 5x)^{\frac{2}{3}}$  Using the binormal theorem is:

$$(1 - 5x)^{\frac{2}{3}} = 1 - \frac{10}{3}x + \frac{40}{9}x^2 + \dots$$

Now,

Let's use the expansion to approximate  $\sqrt[3]{\frac{1}{2}}$  by substituting  $x = \frac{1}{5}$

$$\left(1 - 5\left(\frac{1}{5}\right)\right)^{\frac{2}{3}} = 1 - \frac{10}{3}\left(\frac{1}{5}\right) + \frac{40}{9}\left(\frac{1}{5}\right)^2 + \dots$$

Simplifying:

$$\left(\frac{1}{2}\right)^{\frac{1}{3}} = 1 - \frac{2}{3} + \frac{4}{25}$$

$$\sqrt[3]{\frac{1}{2}} \approx 1 - \frac{2}{3} + \frac{4}{25}$$

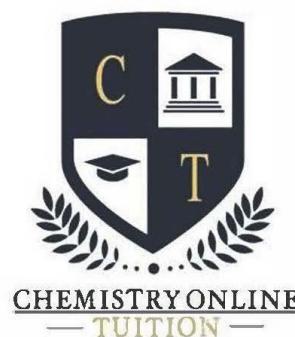
So, by using the binomial expansion, we have an approximation for

$$\sqrt[3]{\frac{1}{2}} \text{ as } \frac{43}{45}.$$

I am Sorry !!!!



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