

# **Sequences and series - Binomial expansion**

Name:
Class:
Date:

Time:
Total marks available:
Total marks achieved:
A Level Mathematics : Pure Mathematics
Subject: Mathematics
Topic 4 : Sequences and series - Binomial expansion Type: Topic Questions

To be used by all students preparing for Edexcel A Level Mathematics - Students of other

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Q1.

(a) Find the first three terms, in ascending powers of *x*, of the binomial expansion of

$$\frac{1}{\sqrt{4-x}}$$

giving each coefficient in its simplest form.

The expansion can be used to find an approximation to  $\sqrt{2}$ Possible values of x that could be substituted into this expansion are:

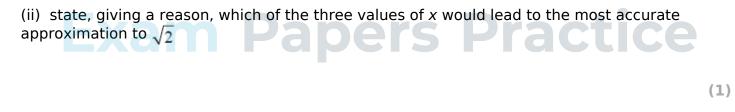
• x = -14 because  $\frac{1}{\sqrt{4-x}} = \frac{1}{\sqrt{18}} = \frac{\sqrt{2}}{6}$ 

• 
$$x = 2$$
 because  $\frac{1}{\sqrt{4-x}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$   
•  $x = -\frac{1}{2}$  because  $\frac{1}{\sqrt{4-x}} = \frac{1}{\sqrt{\frac{9}{2}}} = \frac{\sqrt{2}}{3}$ 

(b) Without evaluating your expansion,

(i) state, giving a reason, which of the three values of *x* should not be used

(1)



## (Total for question = 6 marks)

Q2.

In the binomial expansion of

 $(a + 2x)^7$  where *a* is a constant

the coefficient of  $x^4$  is 15 120

(4)



Find the value of *a*.

Q3.

(a) Find the first four terms, in ascending powers of *x*, of the binomial expansion of

$$\sqrt{4-9x}$$

writing each term in simplest form.

A student uses this expansion with  $x = \frac{1}{9}$  to find an approximation for  $\sqrt{3}$ 

Using the answer to part (a) and without doing any calculations,

(b) state whether this approximation will be an overestimate or an underestimate of  $\sqrt{3}$  giving a brief reason for your answer.

(1)

(4)

# Exam Papers Practice (Total for guestion = 5 marks)

Q4.

$$f(x) = \frac{50x^2 + 38x + 9}{(5x+2)^2(1-2x)} \qquad x \neq -\frac{2}{5} \quad x \neq \frac{1}{2}$$

Given that f(x) can be expressed in the form

$$\frac{A}{5x+2} + \frac{B}{(5x+2)^2} + \frac{C}{1-2x}$$

where A, B and C are constants



- (a) (i) find the value of B and the value of C
- (ii) show that A = 0

(4)

(b) (i) Use binomial expansions to show that, in ascending powers of x

$$f(x) = p + qx + rx^2 + \dots$$

where p, q and r are simplified fractions to be found.

(ii) Find the range of values of x for which this expansion is valid.

#### (Total for question = 11 marks)

- Q5.
- (a) Find the first four terms, in ascending powers of x, of the binomial expansion of

$$(1+8x)^{\frac{1}{2}}$$

giving each term in simplest form. **Papers Practice** 

(b) Explain how you could use x = 1

 $\overline{32}$  in the expansion to find an approximation for  $\sqrt{5}$  .

There is no need to carry out the calculation.

(2)

## (Total for question = 5 marks)

(a) Use the binomial expansion, in ascending powers of x, to show that

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

where k

is a rational constant to be found.

A student attempts to substitute x = 1 into both sides of this equation to find an approximate value for  $\sqrt{3}$ .

(b) State, giving a reason, if the expansion is valid for this value of *x*.

(1)

(4)

#### (Total for question = 5 marks)

Q7.  
(a) Use binomial expansions to show that 
$$\sqrt{\frac{1+4x}{1-x}} \approx 1 + \frac{5}{2}x - \frac{5}{8}x^2$$
 (6)

A student substitutes  $x = \frac{1}{2}$  into both sides of the approximation shown in part (a) in an attempt to find an approximation to  $\sqrt{6}$ 

(b) Give a reason why the student **should not** use  $x = \frac{1}{2}$ 

(1)

(c) Substitute 
$$x = \frac{1}{11}$$
 into  
 $\sqrt{\frac{1+4x}{1-x}} = 1 + \frac{5}{2}x - \frac{5}{8}x^2$ 

to obtain an approximation to  $\sqrt{6}$ . Give your answer as a fraction in its simplest form.

(3) (Total for question = 10 marks)