2. The first 4 terms, in ascending powers of x, in the binomial expansion of

$$(1 + px)^{10}$$

are

$$1 + 15x + qx^2 + rx^3$$

where p, q and r are constants.

Find the value of p, the value of q and the value of r.

(6)

9. Given that

$$3\log_2(t + 4) - 2\log_2(t - 2) = 7$$

(a) verify that $t = 4$ is a solution of the above equation,

(2)

(b) show that

$$t^3 - 116t^2 + 560t - 448 = 0$$

(3)

(c) Hence, using algebra and showing your working, solve

$$3\log_2(t + 4) - 2\log_2(t - 2) = 7$$

giving each answer in simplest form.

(*Solutions based entirely on calculator technology are not acceptable.*)

(4)

5. (a) Find, in terms of a, the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(2 + ax)^6$$

where a is a non-zero constant. Give each term in simplest form.

(3)

$$f(x) = \left(3 + \frac{1}{x}\right)^2 (2 + ax)^6$$

Given that the constant term in the expansion of $f(x)$ is 576

(b) find the value of a.

(4)

7: **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The binomial expansion, in ascending powers of x, of $(1 + kx)^n$ is

$$1 - 24x + 270x^2 + px^3 + \ldots$$

where k and p are constants and n is an integer greater than 1

(a) Use this information to set up and solve two simultaneous equations to find the value of k and the value of n.

(6)

(b) Hence find the value of p.

(2)

DO NOT WRITE IN THIS AREA

6. (a) Given that

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

show that

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

(4)

(b) Given also that -1 is a root of the equation

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

(i) use algebra to find the other two roots of the equation.

(3)

(ii) Hence solve

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

(1)

DO NOT WRITE IN THIS AREA DO NOT

2. The first 4 terms, in ascending powers of x, in the binomial expansion of

$$(1 + px)^{10}$$

are

$$1 + 15x + qx^2 + rx^3$$

where p, q and r are constants.

Find the value of p, the value of q and the value of r.

(6)

DO NOT WRITE IN THIS AR

5. Use the laws of logarithms to solve

$$\log_2(16x) + \log_2(x+1) = 3 + \log_2(x+6)$$

(5)

DO NO

1 Given that

$$\ln(2x+1) - \ln(x-3) = 2,$$

find x in terms of e. [4]

blank

9. A scientist is using carbon-14 dating to determine the age of some wooden items.

The equation for carbon-14 dating an item is given by

$$N = k\lambda^t$$

where

- N grams is the amount of carbon-14 **currently** present in the item
- k grams was the **initial** amount of carbon-14 present in the item
- t is the number of years since the item was made
- λ is a constant, with $0 < \lambda < 1$

(a) Sketch the graph of N against t for $k = 1$

(2)

Given that it takes 5700 years for the amount of carbon-14 to reduce to half its initial value,

(b) show that the value of the constant λ is 0.999878 to 6 decimal places.

(2)

Given that Item A

- is known to have had 15 grams of carbon-14 present initially
- is thought to be 3250 years old

(c) calculate, to 3 significant figures, how much carbon-14 the equation predicts is currently in Item A.

(2)

Item B is known to have initially had 25 grams of carbon-14 present, but only 18 grams now remain.

(d) Use algebra to calculate the age of Item B to the nearest 100 years.

(3)

blank

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

$$(2 + px)^6$$

where p is a constant. Give each term in simplest form.

(4)

Given that in the expansion of

$$\left(3 - \frac{1}{2}x\right)(2 + px)^6$$

the coefficient of x^2 is $-\frac{3}{4}$

(b) find the possible values of p.

(4)

DO NOT WRITE IN THIS AREA

blank

3. (i) Solve

$$7^{x+2} = 3$$

giving your answer in the form $x = \log_7 a$ where a is a rational number in its simplest form.

(3)

(ii) Using the laws of logarithms, solve

$$1 + \log_2 y + \log_2 (y + 4) = \log_2 (5 - y)$$

(5)

DO NOT WRITE IN THIS AREA

4. The binomial expansion, in ascending powers of x, of

$$(3 + px)^5$$

where p is a constant, can be written in the form

$$A + Bx + Cx^2 + Dx^3 \ldots$$

where A, B, C and D are constants.

(a) Find the value of A

(1)

Given that

- $B = 18D$
- $p < 0$

(b) find

(i) the value of p

(ii) the value of C

(6)

DO NOT WRITE IN THIS AREA

2. Find the coefficient of the term in x^7 of the binomial expansion of

$$\left(\frac{3}{8} + 4x\right)^{12}$$

giving your answer in simplest form.

(3)

DO NOT WRITE