

2.4 Solutions to 2.3 Exercise

A-Level Pure Mathematics, Year 2 Geometric Progressions

Answer 1

1 048 575

Answer 2

88 572

Answer 3

(i) 0.8, 0.64, 0.512, 0.4096

(ii) 3.725 122 093

[2, 2, 4 marks]

Answer 4

3.571 054 08

Answer 5

$$a + 2a + 4a + 8a = b + 3b + 9b + 27b$$

$$15a = 40b$$

$$\frac{a}{b} = \frac{8}{3} \quad \square$$

[3, 3 marks]

Answer 6

(i) (a) 460

(b) 529

(c) 608.35

[1, 1, 1 marks]

(ii) 8121

[3 marks]

Answer 7

(i)

$$\frac{k}{k-6} = \frac{2k+5}{k}$$

$$k^2 = (2k+5)(k-6)$$

$$k^2 = 2k^2 - 7k - 30$$

$$k^2 - 7k - 30 = 0 \quad \square$$

[3 marks]

(ii) $\therefore (k-10)(k+3) = 0 \Rightarrow k = 10$

[2 marks]

(iii) The series is 4, 10, 25, ... and so $r = 2.5$

[1 mark]

(iv) 25 429

[2 marks]

Answer 8

5 580 120

[3 marks]

Answer 9

For the Arithmetic Progression...

$$\begin{aligned} S_n &= \frac{n}{2} \{ 2a + (n - 1)d \} \\ &= \frac{10}{2} \{ 2 \times (-2) + (10 - 1)6 \} \\ &= 5 \{ -4 + 54 \} \\ &= 250 \end{aligned}$$

For the Geometric Progression...

$$\begin{aligned} S_n &= \frac{a(r^n - 1)}{(r - 1)} \\ &= \frac{(-2)((-2)^{10} - 1)}{((-2) - 1)} \\ &= \frac{(-2)(1024 - 1)}{-3} \\ &= 682 \end{aligned}$$

So the difference between the two is 432

[4 marks]

Answer 10**(i) METHOD 1**

$$8 + 8r + 8r^2 = 14$$

$$4r^2 + 4r - 3 = 0$$

$$(2r + 3)(2r - 1) = 0$$

$$r = -\frac{3}{2} \text{ or } \frac{1}{2}$$

METHOD 2 (Out of interest - not recommended !)

$$S = \frac{a(r^n - 1)}{(r - 1)} \quad r \neq 1$$

$$14 = \frac{8(r^3 - 1)}{(r - 1)}$$

$$14r - 14 = 8r^3 - 8$$

$$8r^3 - 14r + 6 = 0$$

Divide through by 2

$$4r^3 - 7r + 3 = 0$$

Clearly $r = 1$ is a solution, $\therefore (r - 1)$ is a factor

$$\begin{array}{r}
 \overline{4r^2 + 4r - 3} \\
r - 1 \overline{4x^3 + 0x^2 - 7r + 3} \\
 \underline{4x^3 - 4r^2} \\
 4r^2 - 7r \\
 \underline{4r^2 - 4r} \\
 - 3r + 3 \\
 \underline{- 3r + 3} \\
 0
\end{array}$$

$$(r - 1)(4r^2 + 4r - 3) = 0$$

$$(r - 1)(2r - 1)(2r + 3) = 0$$

$$\text{Either } r = 1 \text{ (reject as } r \neq 1) \text{ or } r = \frac{1}{2} \text{ or } r = -\frac{3}{2}$$

[3 marks]

$$\text{(ii) } 8, 4, 2, 1, 0.5, 0.25 \dots \text{ or } 8, -12, 18, -27, 40.5, -60.75$$

[2 marks]This document is a part of a **Mathematics Community Outreach Project** initiated by Shrewsbury School

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