1.1 Number & Algebra Toolkit

Question Paper

Course	DP IB Maths
Section	1. Number & Algebra
Topic	1.1 Number & Algebra Toolkit
Difficulty	Hard

Time allowed: 80

Score: /61

Percentage: /100

Question 1a

Let $P = \dfrac{(4\sin 2q - 2)(6\tan q + 2)}{10(r+s)^2}$, where $q = \dfrac{\pi}{6}, r = 6$ and $s = 2$.

(a) Calculate the exact value of P.

[4 marks]

Question 1b

(b) Give your answer from part (a) correct to

    (i)   two decimal places

    (ii)   two significant figures.

[2 marks]

Question 2a

Let $W = \dfrac{(2\cos 2x + y)(\tan\frac{x}{2} - z)}{10(5\sin x + z^2)}$, where $x = \dfrac{\pi}{2}, y = -1$ and $z = 2$.

(a) Find the value of W. Give your answer as a fraction.

[4 marks]

Question 2b

(b) Give your answer from part (a) to

    (i)   three decimal places

    (ii)   three significant figures.

[2 marks]

Question 3a

A prism has a cross sectional area of 5.50×10^3 cm^2 and volume of 4.40×10^4 cm^3.

(a) Calculate the length of the prism.

[3 marks]

Question 3b

The cross-sectional area of the prism is in the shape of a trapezium and its parallel sides measure 2 m and 2.4 m.

(b) Calculate the height of the trapezium. Give your answer in cm.

[3 marks]

Question 4a

Mary has found the exact answer for R is $\dfrac{45}{16}$.

(a) Write down the exact answer of R as a decimal.

[3 marks]

Question 4b

(b) Give your answer from part (a) correct to

(i) three decimal places

(ii) one significant figure.

[2 marks]

Question 5a

It is given that $\sin a = \frac{\sqrt{3}}{2}$ and $\sin b = \frac{1}{2}$, where $a \leq 180°$ and $b \leq 180°$.

(a) Find the size of the angles a and b.

[2 marks]

Question 5b

A circle has radius r equal to $\sqrt{\dfrac{\sin a}{\sin b}}$ cm.

(b) Find the exact value of the area of the circle, giving your answer in terms of π.

[4 marks]

Question 6a

A medium rare steak should have an internal temperature of 55°C to 56°C. Max decides to go 10 different steak houses, he measures the internal temperature of a medium rare steak at each establishment and records the following:

$$51.0, \quad 52.1, \quad 62.9, \quad 49.0, \quad 59.8, \quad 50.2, \quad 54.3, \quad 47.7, \quad 48.6, \quad 65.4$$

(a) Find the mean internal temperature of Max's recordings.

[1 mark]

Question 6b

Max goes to 5 more steak houses and calculates the mean of all 15 restaurants to be 55.2°C.

(b) Calculate the mean internal temperature from the 5 additional steak houses Max went to.

[3 marks]

Question 6c

Max records one last steak that has an internal temperature of T °C.

(c) Calculate the interval of T such that the mean internal temperature for all 16 steaks is within the temperature range for a medium rare steak.

[3 marks]

Question 7

The diameter of Earth is 1.274×10^7 m, correct to four significant figures. The circumference of Mars is 2.134×10^7 m, correct to four significant figures.

Modelling Earth and Mars as perfect spheres, find the difference between the volume of Earth and the volume of Mars, giving your answer in the form $a \times 10^k$, where $1 \leq a < 10, k \in \mathbb{Z}$.

[5 marks]

Question 8

Solve the following systems of linear equations using technology.

(i)

$$5x + 3y - 2z = -12$$
$$3x - 4y - z = 17$$
$$10x - 10y + z = 65$$

(ii)

$$4x - 5y + z = 50$$
$$3x + y + 3z = -16$$
$$6x - 2z = 61 + y$$

[6 marks]

Question 9a

(a) Write $\dfrac{2x + 17}{(x + 4)(x - 5)}$ as a sum of partial fractions.

[2 marks]

Question 9b

(b) Write $\dfrac{8x-7}{2x^2 - x - 3}$ as a sum of partial fractions.

[3 marks]

Question 9c

(c) Write $\dfrac{37 - 7x}{2x^2 + 3x - 20}$ as a sum of partial fractions.

[3 marks]

Question 10a

The expression $\dfrac{5x^2 + 7x}{(2x + 1)(x^2 - 1)}$ can be written as the sum of partial fractions in the form

$\dfrac{A}{2x + 1} + \dfrac{B}{x + a} + \dfrac{C}{x - a}$, where $a, A, B, C \in \mathbb{Z}$.

(a) Write down the value of a.

[1 mark]

Question 10b

(b) Find the values of A, B, and C.

[5 marks]