1.1 Number Toolkit

Question Paper

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

Time allowed: 40

Score: /32

Percentage: /100

Question 1a

Consider the numbers $a = 11\sqrt{2}, b = (5 + 6\pi), c = \sqrt{2}, d = 6(\pi - 1)$.

(a) Giving your answer to 1 decimal place, calculate the value of

(i) a.

(ii) b.

(iii) c.

(iv) d.

[2 marks]

Question 1b

Points P and Q have coordinates (a, b) and (c, d) respectively.

The formula for the distance, d, between two points with coordinates (x_1, y_1) and (x_2, y_2) is given in your formula booklet.

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

(b) Using your answers from part (a), calculate the distance, d, between points P and Q. Give your answer correct to 1 decimal place.

[2 marks]

Question 2

Let $Y = (pq)^{-2}r^3$ and $T = pqr^{-1}$, where $p = \sin\frac{\pi}{3}$, $q = \sqrt{3}$, $r = 2$.

Find the exact value of YT.

[5 marks]

Question 3a

Point A has coordinates $(-1, 7)$ and point B has coordinates $(11, 12)$.

The formula for the distance, d, between two points with coordinates (x_1, y_1) and (x_2, y_2) is given in your formula booklet.

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

(a) Calculate the distance between points A and B.

[3 marks]

Question 3b

The formula for the coordinates of the midpoint of a line segment with endpoints (x_1, y_1) and (x_2, y_2) is given in your formula booklet.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

(b) Calculate the midpoint of the line segment with endpoints A and B.

[2 marks]

Question 4a

Let $S = (a \sin^2 4b)(c^2 \tan^2 12d)^{-1}\left(\sqrt{a} + c - \cos 48b\right)$, where $a = 16, b = 7.5°, c = 3$ and $d = 5°$.

Note: $\sin^2\theta = (\sin\theta)^2$

(a) Find the value of S, giving your answer as a fraction.

[2 marks]

Question 4b

Let $X = \frac{\sqrt{a}+c^2-2\sin 54d}{\sqrt{a^3}-a-c}$

(b) Find the value of X, giving your answer as a fraction.

[2 marks]

Question 4c

(c) Calculate the value of SX, giving your answer as a fraction.

[2 marks]

Question 5a

Consider the numbers $p = 2.41 \times 10^4$ and $q = 4.12 \times 10^5$.

(a) Giving your answers in the form $a \times 10^k$, where $1 \leq a < 10, k \in \mathbb{Z}$, calculate

(i) $p + q$

(ii) $p - q$

(iii) $q - p$

(iv) $\frac{p}{q}$.

[4 marks]

Question 5b

The formula for the distance, d, between two points with coordinates (x_1, y_1) and (x_2, y_2) is given in your formula booklet.

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

(b) Using your answers to part (a), estimate the distance between points A$(p + q, p - q)$ and B$\left(q - p, \frac{p}{q}\right)$.

[2 marks]

Question 6

The mean height of the four tallest students in a classroom is 176 cm and the mean height of the six tallest students is 165 cm. The fifth tallest student is 4 cm taller than the sixth tallest student.

Find the heights of the fifth and sixth tallest students.

[6 marks]