IB · DP · Maths

1 hour 9 questions

Practice Paper 1

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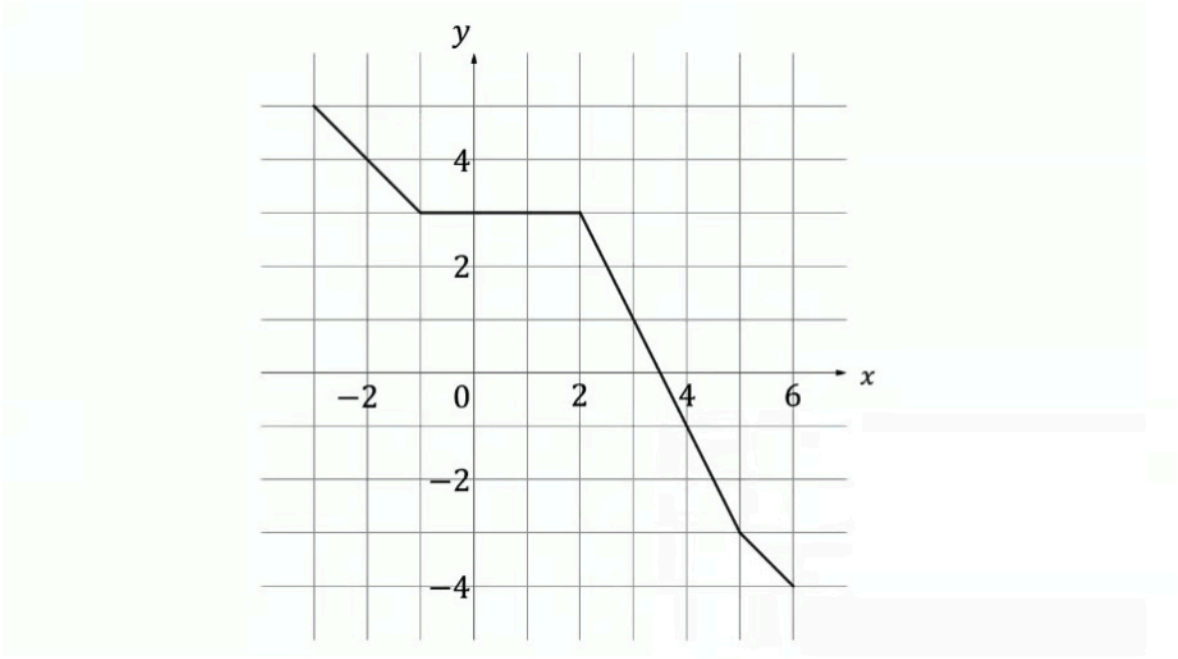
Total Marks /80

1 (a) The following diagram shows the graph of $y = f(x), -3 \leq x \leq 6$.



Write down the value of

i) $f(-2)$

ii) $f^{-1}(1)$.

(2 marks)

(b) Find the value of $(f \circ f)(0)$.

(1 mark)

(c) Given that $g(x) = f(x + 5) - 5$, find the domain and range of g.

(2 marks)

2 (a) The diameter of our moon is roughly 3.5 x 10^3 km. Honzos is a spherical moon in a nearby galaxy and its diameter is eight times larger than our moon's.

State the radius of Honzos, giving your answer in standard form.

(2 marks)

(b) Approximately 75% of the surface of Honzos is available for cultivation.

The approximate surface area of Honzos that is available for cultivation can be expressed in the form $\pi(a \times 10^b)\ km^2$, where $1 \leq a < 10$ and $b \in \mathbb{Z}$.

State the values of a and b.

(3 marks)

3 (a) Students are arranged for a graduation photograph in rows which follows an arithmetic sequence. There are 20 students in the fourth row and 44 in the 10th row.

i) Find the common difference, d, of the arithmetic sequence.

ii) Find the first term of the arithmetic sequence.

(3 marks)

(b) Given there are 20 rows of students in the photograph, calculate how many students there are altogether.

(3 marks)

4 (a) The heights, in metres, of a flock of 20 flamingos are recorded and shown below:

0.4	0.9	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.2
1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.6

An outlier is an observation that falls either more than 1.5 x (interquartile range) above the upper quartile or less than 1.5 X (interquartile range) below the lower quartile.

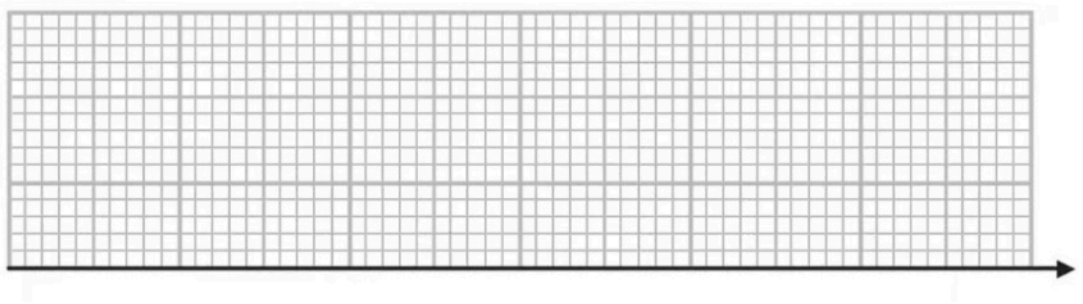
i) Find the values of Q_1, Q_2 and Q_3.

ii) Find the interquartile range.

iii) Identify any outliers.

(4 marks)

(b) Using your answers to part (a), draw a box plot for the data.



(3 marks)

5 Let $f(x) = \frac{g(x)}{h(x)}$, where $g(2) = 4$, $h(2) = -1$, $g'(2) = 0$ and $h'(2) = 2$.

Find the equation of the tangent of f at $x = 2$.

(6 marks)

6 (a) Prove that $\sqrt{3}\sin 2\theta + \cos 2\theta - 1 = 2\sin\theta(\sqrt{3}\cos\theta - \sin\theta)$.

(3 marks)

(b) Hence solve $\sqrt{3}\sin 2\theta + \cos 2\theta + 3\cos\theta - \sqrt{3}\sin\theta = 1$, where $0 \leq \theta < 360°$.

(5 marks)

7 (a) $f(x) = 2mx^2 + 3mx$ where $x \in \mathbb{R}$ and $m \neq 0$. The line $y = -3mx - 9$ meets the graph of f at exactly one point.

Show that $m = 2$.

(3 marks)

(b) f can be written in the form $(2x)(2x + h)$, where $h \in \mathbb{R}$.

Find the value of h.

(1 mark)

(c) f can also be written in the form $4(x + q)^2 + r$, where $q, r \in \mathbb{R}$.

Find the values of q and r.

(3 marks)

(d) By sketching the graph of f, find the values of x where the graph is both negative and decreasing.

(3 marks)

(e) Find the area enclosed by $f(x)$ and the x-axis.

(4 marks)

8 (a) Let $f(x) = kx\ \mathrm{In}(3x^4)\ for\ x > 0$, where $k > 0$ is a constant.

Given that $f(a) = 0$, find the value of a.

(3 marks)

(b) Find

i) $f'(x)$

ii) $f''(x)$

(5 marks)

(c) Show that the graph of f has exactly one minimum point and determine its x-coordinate.

(5 marks)

(d) Given that the y-coordinate of the minimum point is -4, find the value of k.

(3 marks)

9 (a) Frank has a biased six-sided die.
The faces of the die are numbered 1 to 6.
Frank's score, X, is the number which lands face up after his die is rolled.
The following table shows the probability distribution for X.

Score , x	1	2	3	4	5	6
$P(X = x)$	$\frac{1}{10}$	$\frac{1}{20}$	$\frac{1}{5}$	$\frac{3}{20}$	$\frac{1}{5}$	$\frac{3}{10}$

Frank plays the game twice and adds the scores together.

Find the probability Frank has a total score of 4, giving your answer as a fraction.

(3 marks)

(b) Jenny has a different biased six-sided die.
On Jenny's die, the faces are numbered as multiples of 3.
Jenny's score, Y, is the number which lands face up after her die is rolled.
The following table shows the probability distribution for Y.

Score , y	3	6	9	12	15	18
$P(Y = y)$	a	a	b	b	b	b

It is given that the range of possible values for a is $0 < a < \frac{1}{2}$.

i) Find the range of possible values for b.

ii) Hence, find the range of possible values for $E(Y)$.

(4 marks)

(c) Frank and Jenny each roll their die once. The probability that Frank's score is at least as high as Jenny's is $\frac{23}{80}$.

Find the value of $E(Y)$.

(6 marks)