

HKDSE MATH CORE 2022 Past Paper I

1. HKDSE MATH CORE 2022 Past Paper I Q1

Simplify $\frac{(a^3b^{-2})^4}{a^{-5}b^6}$ and express your answer with positive indices.
(3 marks)

2. HKDSE MATH CORE 2022 Past Paper I Q2

Let x and y be two numbers. The sum of x and y is 456 while the product of 7 and x is y . Find x .
(3 marks)

3. HKDSE MATH CORE 2022 Past Paper I Q3

Simplify $\frac{3}{k-9} + \frac{2}{5k+6}$.
(3 marks)

4. HKDSE MATH CORE 2022 Past Paper I Q4

Factorize

(a) $9c^2 - 6x + 1$,

(b) $(4c + d)^2 - 9c^2 + 6x - 1$.

(4 marks)

5. HKDSE MATH CORE 2022 Past Paper I Q5

A fan is sold at a discount of 30% on its marked price. After selling the fan, the profit is \$78 and the percentage profit is 26%. Find the marked price of the fan.
(4 marks)

6. HKDSE MATH CORE 2022 Past Paper I Q6

Consider the compound inequality

$$-2(3x + 2) > x + 10 \text{ or } 2x \leq -8 \dots\dots\dots (*).$$

(a) Solve (*).

(b) Write down the greatest integer satisfying (*).

(4 marks)

7. HKDSE MATH CORE 2022 Past Paper I Q7

The coordinates of the points S and T are $(12, -5)$ and $(-3, -7)$ respectively. S is rotated anticlockwise about O through 90° to S' , where O is the origin. T' is the reflection image of T with respect to the x -axis.

(a) Write down the coordinates of S' and T' .

(b) Find the slope of $S'T'$.

(4 marks)

8. HKDSE MATH CORE 2022 Past Paper I Q8

In Figure 1, A is a point lying inside the quadrilateral $BCDE$ such that $AC \parallel ED$ and $AD \parallel BC$. It is given that $\angle ABD = \angle AED$ and $AB = AE$.

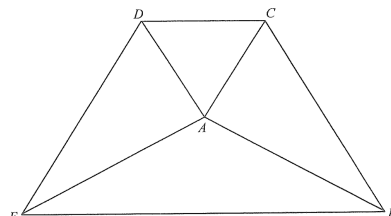


Figure 1

(a) Prove that $\triangle ABC \equiv \triangle AED$.

(b) If $\angle ABC = 39^\circ$ and $\angle DAE = 87^\circ$, find $\angle ACD$.

(5 marks)

9. HKDSE MATH CORE 2022 Past Paper I Q9

The frequency distribution table and the cumulative frequency distribution table below show the distribution of the times taken to complete a 3 km race by a group of students.

Time taken (minutes)	Frequency
10 – 14	a
15 – 19	9
20 – 24	b
25 – 29	3

Time taken less than (minutes)	Cumulative frequency
14.5	3
19.5	x
24.5	y
29.5	20

(a) Write down the value of x .

(b) Find the mean of the distribution.

(c) Find the probability that the time taken to complete the 3 km race by a randomly selected student from the group is less than 19.5 minutes.

(5 marks)

10. HKDSE MATH CORE 2022 Past Paper I Q10

It is given that $f(x)$ partly varies as x^2 and partly varies as x . Suppose that $f(4) = 96$ and $f(-5) = 15$.

(a) Find $f(x)$.

(3 marks)

(b) Write down the x -intercept of the graph of $y = 8f(x)$.

(1 marks)

- (c) Let k be a real constant. Find the range of values of k such that the equation $f(x) = k$ has two distinct real roots.
(2 marks)

11. HKDSE MATH CORE 2022 Past Paper I Q11

The stem-and-leaf diagram below shows the distribution of the ages of the players of a football team. The inter-quartile range and the median of the distribution are 14 and 31 respectively.

Stem (tens)	Leaf (units)
1	7 8 9
2	0 a a 8 8 9
3	b b 5 5 6 6 6 6 7 8
4	3

- (a) Find a and b .
(3 marks)
- (b) A player now leaves the football team.
- (i) Is there any change in the mode of the distribution due to the leaving of the player? Explain your answer.
- (ii) If the range of the distribution is decreased, find the greatest possible standard deviation of the distribution.
(4 marks)

12. HKDSE MATH CORE 2022 Past Paper I Q12

The equation of the circle C is $x^2 + y^2 - 154x - 128y + 224 = 0$. Denote the centre of C by G . The coordinates of the point H are $(65, 48)$.

- (a) Find the distance between G and H .
(3 marks)
- (b) Let P be a moving point on C . When the area of $\triangle GHP$ is the greatest,
- (i) describe the geometric relationship between GH and GP ;
- (ii) find the perimeter of $\triangle GHP$.
(4 marks)

13. HKDSE MATH CORE 2022 Past Paper I Q13

There are two solid metal spheres. The ration of the surface area of the smaller sphere to the surface area of the larger sphere is 4:9. The radius of the larger sphere 9 cm.

- (a) Express, in terms of π , the volume of the smaller sphere.
(3 marks)

- (b) The two spheres are melted and recast into two solid right circular cones. Denote these two circular cones by A and B . It is given that the height and the base radius of A are 10 cm and 6 cm respectively. A student finds that the base radius of B is 12 cm. The student claims that A and B are similar. Is the claim correct? Explain your answer.

(4 marks)

14. HKDSE MATH CORE 2022 Past Paper I Q14

Let $p(x) = 2x^3 + ax^2 + bx - 20$, where a and b are constants. When $p(x)$ is divided by $x^2 - 2x + 3$, the remainder is $x + 13$.

- (a) Find a and b .

(3 marks)

- (b) Is $x - 5$ a factor of $p(x)$? Explain your answer.

(2 marks)

- (c) Someone claims that the equation $p(x) = 0$ has two irrational roots. Do you agree? Explain your answer.

(3 marks)

15. HKDSE MATH CORE 2022 Past Paper I Q15

There are 10 boys and 12 girls in a class. If 4 students are randomly selected from the class to form a committee.

- (a) find the probability that there are 2 boys and 2 girls in the committee.

(2 marks)

- (b) find the probability that the number of boys and the number of girls in the committee are different.

(2 marks)

16. HKDSE MATH CORE 2022 Past Paper I Q16

Let $g(x) = 3x^2 + 12kx^2 + 16k^2 + 8$, where k is a non-zero constant.

- (a) Using the method of completing the square, express, in terms of k , the coordinates of the vertex of the graph of $y = g(x)$.

(2 marks)

- (b) On the same rectangular coordinates system, denote the vertex of the graph of $y = g(x)$ and the vertex of the graph of $y = 2g(-x)$ by A and B respectively. Let M be a point lying on AB such that the area of $\triangle OBM$ is the triple of the area of $\triangle OAM$, where O is the origin. Express, in terms of k , the coordinates of M .

(3 marks)

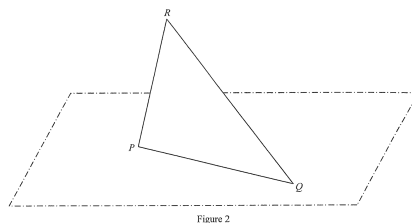
17. HKDSE MATH CORE 2022 Past Paper I Q17

Let c be a real constant. The roots of the equation $x^2 + cx - 9 = 0$ are α and β .

- (a) Express $\alpha^2 + \beta^2$ in terms of c .
(3 marks)
- (b) The 1st term, the 2nd term and the 3rd term of an arithmetic sequence are c^2 , $\alpha^2 + \beta^2$ and 85 respectively. Find the least value of n such that the sum of the first n terms of the sequence is greater than 2×10^6 .
(4 marks)

18. HKDSE MATH CORE 2022 Past Paper I Q18

In Figure 2, the triangular paper and PQR is held such that PQ lies on the horizontal ground. It is given that $PQ = 30$ cm, $PR = 25$ cm and $\angle QPR = 95^\circ$.



- (a) Find
- the length of QR ,
 - $\angle PQR$.
- (4 marks)
- (b) Let M be the mid-point of QR . A craftman finds that the angle between PR and the horizontal ground is 70° . The craftman claims that the angle between PM and the horizontal ground exceeds 40° . Is the claim correct? Explain your answer.
(3 marks)

19. HKDSE MATH CORE 2022 Past Paper I Q19

The centre of the circle C is the point $G(83, 112)$. It is found that the point $A(158, 12)$ lies outside C , AP and AQ are the tangents to C at the points P and Q respectively. It is given that C passes through the point $(23, 67)$.

- Find the equation of the straight line passing through A and G .
(2 marks)
- Find the coordinates of the point of intersection of AG and PQ .
(3 marks)
- Find the equation of the inscribed circle of $\triangle APQ$.
(4 marks)
- Someone claims that the ratio of the area of the inscribed circle to the area of the circumcircle of $\triangle APQ$ is $1 : 4$. Do you agree? Explain your answer.
(3 marks)