

Hong Kong Mathematics Olympiad (2017/18)
Final Event 1 (Group)

FOR OFFICIAL USE

Score for accuracy	<input type="text"/>	×	Mult. factor for speed	<input type="text"/>	=	<input type="text"/>	Team No.	<input type="text"/>
			+	Bonus score		<input type="text"/>	Time	<input type="text"/>
							Min.	Sec.
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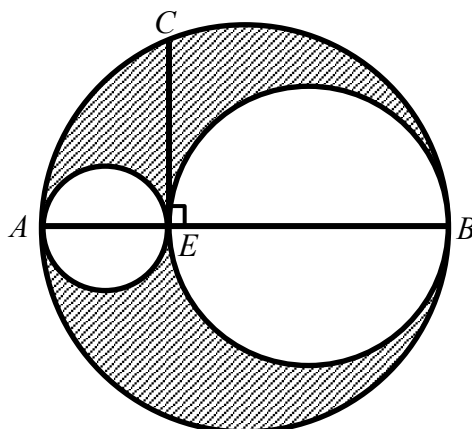
Unless otherwise stated, all answers should be expressed in numerals in their simplest forms.
除非特别声明，答案须用数字表达，并化至最简。

1. Suppose that Mary and Ming obtained an integer score either s or t in each of the subjects: Chinese, English and Mathematics, where $s > t > 0$. It is known that Mary did better in Chinese but Ming did better in English. Mary's and Ming's total scores are 12 and 9, respectively. Determine the value of s .

瑪莉和小明在中文科、英文科及數學科獲得的分數為 s 或 t 的整數，且 $s > t > 0$ 。若瑪莉於中文科的分數比小明的高以及小明於英文科的分數比瑪莉的高，而瑪莉和小明的總分分別是 12 分和 9 分。求 s 的值。

$s =$

2. Given that two circles, one with diameter AE and the other with diameter BE , are inscribed by a large circle with diameter AB . If $CE \perp AB$ with $AB = 10$ and $CE = 4$, and the total area of the shaded regions is $w\pi$, determine the value of w .
已知兩圓的直徑為 AE 及 BE ，內接於直徑為 AB 的圓中。若 $CE \perp AB$ ， $AB = 10$ ， $CE = 4$ 及着色部份的總面積為 $w\pi$ ，求 w 的值。



$w =$

3. Let m and r be non-negative integers. If $f(7m+r) = r$, determine the value of $q = f(2^{2018})$.

設 m 及 r 為非負整數。若 $f(7m+r) = r$ ，求 $q = f(2^{2018})$ 。

$q =$

4. In base-5 system, if v is the remainder of $234234_5 \div 234_5$, determine the value of v .

在五进制中，若 v 为 $234234_5 \div 234_5$ 的余数，求 v 的值。

$v =$

Hong Kong Mathematics Olympiad (2017/18)
Final Event 2 (Group)

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							Min.	Sec.
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1. Given that $u > 0$ and $\frac{1-2^{-\frac{1}{u}}}{2^{-\frac{1}{u}}-2^{-\frac{2}{u}}}=4$, determine the value of u .

已知 $u > 0$ 及 $\frac{1-2^{-\frac{1}{u}}}{2^{-\frac{1}{u}}-2^{-\frac{2}{u}}}=4$ ，求 u 的值。

$u =$

2. Given that $b \geq 1$, $a-12b=15$ and x is a real number, determine the least value of

$$v = \frac{(x-a)^2}{2b} + 5x.$$

已知 $b \geq 1$ 、 $a-12b=15$ 及 x 是实数，求 $v = \frac{(x-a)^2}{2b} + 5x$ 的最小值。

$v =$

3. Suppose that there were 20 boys and 15 girls in a class having taken two tests. Given that 8 students failed the first test, 12 students failed the second test, and 6 students failed both tests, if 5 boys failed the first test, 7 boys failed the second test, 4 boys failed both tests, and n girls passed both tests, determine the value of n .

若班中有 20 位男同学及 15 位女同学参加两次考试。已知 8 位同学在第一次考试中不合格，12 位同学在第二次考试中不合格，及 6 位同学于两次考试均不合格。若 5 位男同学在第一次考试中不合格，7 位男同学在第二次考试中不合格，4 位男同学两次考试均不合格及 n 位女同学两次考试均合格，求 n 的值。

$n =$

4. Determine the least positive integer m such that $m^{200} > 6^{300}$.

求最小正整数 m ，使得 $m^{200} > 6^{300}$ 。

$m =$

Hong Kong Mathematics Olympiad (2017/18)
Final Event 3 (Group)

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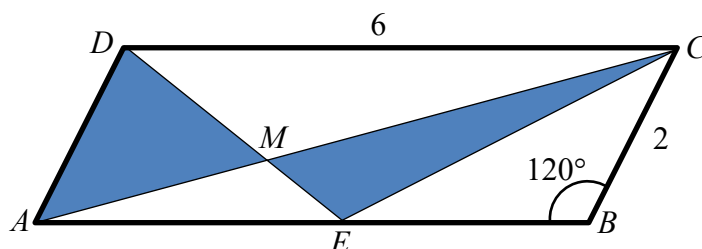
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1. $ABCD$ is a parallelogram with diagonal AC , $CD = 6$, $BC = 2$ and $\angle ABC = 120^\circ$. If E is the midpoint of AB , AC and DE intersect at M , and the total area of the shaded regions is α , determine the value of α .

AC 是平行四边形 $ABCD$ 的对角线， $CD = 6$ ， $BC = 2$ 及 $\angle ABC = 120^\circ$ 。若 E 是 AB 的中点， AC 与 DE 相交于 M 及着色部分的总面积是 α ，求 α 的值。



$\alpha =$

2. If β is a 3-digit positive integer that is divisible by 11 and whose quotient when divided by 11 is 3 times the sum of its digits, determine the largest value of β .

设 β 为三位正整数且能被 11 整除，且其商相等于其值的各数字之和的三倍，求 β 的最大值。

$\beta =$

3. Determine the largest real value of φ such that the inequality $\sqrt{1-\varphi} - \sqrt{1+\varphi} \geq 1$ holds.

求 φ 的最大实数值，使不等式 $\sqrt{1-\varphi} - \sqrt{1+\varphi} \geq 1$ 成立。

$\varphi =$

4. Suppose that θ and γ are positive integers, where $\theta < \gamma$.

If $\frac{\theta+\gamma}{2} : \sqrt{\theta\gamma} = 13:12$, determine the least value of γ .

设 θ 及 γ 为正整数，当中 $\theta < \gamma$ 。若 $\frac{\theta+\gamma}{2} : \sqrt{\theta\gamma} = 13:12$ ，求 γ 的最小值。

$\gamma =$

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Final Event 4 (Group)

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1. Let $X = \sqrt{2018 - \sqrt{A}}$ be a positive integer. Determine the largest value of A .
设 $X = \sqrt{2018 - \sqrt{A}}$ 是正整数。求 A 的最大值。

$A =$

2. Determine the value of B , the product of all the real roots of $(12x-1)(6x-1)(4x-1)(3x-1)=5$.
求方程 $(12x-1)(6x-1)(4x-1)(3x-1)=5$ 的所有实根之乘积 B 的值。

$B =$

3. Determine the value of

$$C = \cos \frac{\pi}{15} \times \cos \frac{2\pi}{15} \times \cos \frac{3\pi}{15} \times \cos \frac{4\pi}{15} \times \cos \frac{5\pi}{15} \times \cos \frac{6\pi}{15} \times \cos \frac{7\pi}{15}.$$

求 $C = \cos \frac{\pi}{15} \times \cos \frac{2\pi}{15} \times \cos \frac{3\pi}{15} \times \cos \frac{4\pi}{15} \times \cos \frac{5\pi}{15} \times \cos \frac{6\pi}{15} \times \cos \frac{7\pi}{15}$ 的值。

$C =$

4. Let r , s and t be positive real numbers with $r^2 + s^2 + t^2 = rs + st + rt$. If $r = 1$, determine the value of $D = s + t$.

设 r , s and t 是正实数，且 $r^2 + s^2 + t^2 = rs + st + rt$ 。若 $r = 1$ ， $D = s + t$ 的值。

$D =$