1.考慮數據 5,6,3,8,5,9。令 σ 爲其標準差，而m爲其平均差。求 $|\sigma^2 - m|$ 爲何?

Consider the data 5,6,3,8,5,9. Let σ be the standard deviation and m the mean deviation(average deviation) of the data. What is the absolute value $|\sigma^2 - m|$?

(a) 0

(b) $\frac{1}{2}$

(c) $\frac{5}{2}$

(d) $\frac{7}{3}$

(e) 以上皆非　None of the above

2.求函數$f(x) = (3x - 1)^3(x^2 + 5)^2$ 在 $x = 0$ 的微分值。

Find the derivative of the function $f(x) = (3x - 1)^3(x^2 + 5)^2$ at $x = 0$.

(a) 0
(b) 25
(c) 30
(d) 225
(e) 以上皆非　None of the above

3.令函數 $y = x^2 - 3x - 4$在$(3, -4)$的切線爲L。求L與 x-軸的交點的 x座標值。

Let L be the tangent line of the curve $y = x^2 - 3x - 4$ at $(3, -4)$. Find the x coordinate of the point of intersection of L and the x-axis.

(a) $\frac{-13}{3}$

(b) -13
(c) 0
(d) 3
(e) 以上皆非　None of the above

4.下列哪一個方程式代表一條與橢圓 $x^2 + 4y^2 = 5$ 相切的直線?

Which of the following equations represents a tangent line to the ellipse $x^2 + 4y^2 = 5$?

(a) $x + y = \frac{-5}{2}$

(b) $x + y = \frac{-3}{2}$

(c) $x + y = \frac{1}{2}$

(d) $x + y = \frac{3}{2}$

(e) 以上皆非 None of the above

5.請問有幾種不同的方法可以將 35 寫成兩個以上的連續正整數的和。

How many different ways are there to write 35 as a sum of consecutive positive integers.

(a) 2

(b) 4

(c) 6

(d) 8

(e) 以上皆非 None of the above

6.以下何者為 $1 + i$ 的四次方根?

Which of the following is a 4th root of $1 + i$?

(a) $\sqrt[8]{2}\left(\cos\frac{3\pi}{16} + i\sin\frac{3\pi}{16}\right)$

(b) $\sqrt[8]{2}\left(\cos\frac{5\pi}{16} + i\sin\frac{5\pi}{16}\right)$

(c) $\sqrt[8]{2}\left(\cos\frac{7\pi}{16} + i\sin\frac{7\pi}{16}\right)$

(d) $\sqrt[8]{2}\left(\cos\frac{9\pi}{16} + i\sin\frac{9\pi}{16}\right)$

(e) 以上皆非 None of the above

7.敘述 $|x+1|+3|x-2| < 6$ 與下列何者等值?

Which of the following statement is equivalent to $|x+1|+3|x-2| < 6$?

(a) $\frac{1}{2} < x < 3$

(b) $\frac{1}{2} < x < \frac{11}{4}$

(c) $1 < x < 3$

(d) $1 < x < \frac{11}{4}$

(e) 以上皆非 None of the above

8.令 A 為一菱形而 B 為一正方形。如果 A 與 B 具有等長的邊，但是 A 的面積只有 B 的一半，則 A 的長對角線與短對角線的長度比為何?

Let A be a rhombus and B a square. If A and B have the same length for their sides, but the area of A is half of that of B, what is the ratio of the length of the long diagonal of A to that of the short diagonal of A?

(a) $2 - \sqrt{3}$

(b) $\frac{1}{2}$

(c) $\sqrt{3}$

(d) $2 + \sqrt{3}$

(e) 以上皆非 None of the above

9.令 C 為由方程式 $4x^2 + 4y^2 - 20x + 4y + 18 = 0$ 所定義出來的圓，而 L 為過原點 $O(0,0)$ 且與 C 相切於點 B 的直線。求點 B 與 O 的距離。

Let C be the circle given by the equation $4x^2 + 4y^2 - 20x + 4y + 18 = 0$, and let L be a straight line passing through the origin $O(0,0)$ and tangent at a point B on the circle C. Find the distance between O and B.

(a) $\frac{\sqrt{6}}{2}$

(b) 2

(c) $\frac{\sqrt{18}}{2}$

(d) $\frac{\sqrt{21}}{2}$

(e) 以上皆非 None of the above

10.令 x,y,z 爲三個未知元。在展開 $(x+y+z)^5$ 後 x^2yz 的係數爲何?

Let x,y,z be indeterminates. After expanding, what is the coefficient of x^2yz in $(x+y+z)^5$?

(a) 250

(b) 500

(c) 1000

(d) 2000

(e) 以上皆非　None of the above

11.一個盒子中有兩個新球以及三個舊球。如果連續由盒中取出兩個球(一次一個，不放回)，則拿到兩個新球的機率是多少?

There are 5 balls in a box with two of them new and three of them old. If we take two balls out from the box, one at a time without putting them back into the box, then what would be the probability of getting two new balls?

(a) $\frac{1}{20}$

(b) $\frac{1}{10}$

(c) $\frac{3}{20}$

(d) $\frac{3}{10}$

(e) 以上皆非　None of the above

12.假設 x,y,z 爲正實數，且滿足 $xy=z, xz=2y,$ 及 $yz=4x$ 。下列何者是 $x+y+z$?

Suppose that x,y,z are positive real numbers satisfying $xy=z, xz=2y,$ and $yz=4x$ .Which of the following is $x+y+z$?

(a) $2+\sqrt{2}$

(b) $2+2\sqrt{2}$

(c) $2+3\sqrt{2}$

(d) $3+2\sqrt{2}$

(e) 以上皆非　None of the above

13.令 (x,y,z) 爲聯立方程組 $\begin{cases} x - 2y + 3z = 6 \\ 2x + 3y - 4z = 20 \\ 3x - 2y - 5z = 6 \end{cases}$ 的解。求 $x + y + z$

Let (x,y,z) be the solution of the system of equations $\begin{cases} x - 2y + 3z = 6 \\ 2x + 3y - 4z = 20. \\ 3x - 2y - 5z = 6 \end{cases}$ Then

$x + y + z$ is

(a) 14
(b) 15
(c) 16
(d) 17
(e) 以上皆非 None of the above

14.令 $A = \begin{pmatrix} 1 & -1 & 1 \\ a & 1 & 3 \\ 3 & 4 & b \end{pmatrix}$。下列何者會使 A 成爲可逆矩陣?

Let $A = \begin{pmatrix} 1 & -1 & 1 \\ a & 1 & 3 \\ 3 & 4 & b \end{pmatrix}$. Which of the following makes A an invertible matrix?

(a) $(a,b) = (0,24)$
(b) $(a,b) = (6,0)$
(c) $(a,b) = (1,10)$
(d) $(a,b) = (10,1)$
(e) 以上皆非 None of the above

15.令 $y = f(x)$ 爲定義於閉區間 $[a,b]$, $a < b$, 且對所有 $x \in [a,b]$, $f(x) > 0$。由曲線 $y = f(x)$, $y = 0$, $x = a$ 及 $x = b$ 所圍住的區域記爲 A。下面哪一個式子表示區域 A 繞 x-軸旋轉所得的旋轉體的體積?

Let $y = f(x)$ be a continuous function defined on the closed interval $[a,b]$, $a < b$, with $f(x) > 0$ for all $x \in [a,b]$. Denote by A the region bounded by the curve $y = f(x)$, $y = 0$, $x = a$, and $x = b$. Which of the following gives the volume of the solid generated by revolving A along the x-axis?

(a) $\dfrac{4\pi}{3} f(x)^3$

(b) $\displaystyle\int_a^b \dfrac{4\pi}{3} f(x)^3\,dx$

(c) $\displaystyle\int_a^b \pi f(x)^2\,dx$

(d) $\displaystyle\int_a^b 2\pi f(x)\,dx$

(e) 以上皆非 None of the above

16. 函數 $y = x^2 e^x$ 與 x-軸在 $0 \le x \le 1$ 範圍內所圍住的區域面積爲

The area of the region between the function $y = x^2 e^x$ and the x-axis for $0 \le x \le 1$ is

(a) 0

(b) $e - 2$

(c) $e - 1$

(d) $2e - 1$

(e) 以上皆非 None of the above

17. 令 $f(x) = \dfrac{2x-1}{x-1}$。下面何者爲 $f(x)$ 的圖形的漸進線?

Let $f(x) = \dfrac{2x-1}{x-1}$. Which of the following is an asymptote of the graph of $f(x)$?

(a) $y = -2$

(b) $x = 1$

(c) $y = 1$

(d) $x = 2$

(e) 以上皆非 None of the above

18. 假設 a 是一個實數使得函數 $f(x) = a\sin x + \dfrac{1}{3}\sin 3x$ 在 $x = \dfrac{\pi}{3}$ 處有極值。則 a 爲何?而此極值是極大值還是極小值?

Suppose that a is a real number such that the function $f(x) = a\sin x + \dfrac{1}{3}\sin 3x$ has an extremum at $x = \dfrac{\pi}{3}$. What is a? Is the extremum a maximum or a minimum?

(a) $a = -2$，極小值 minimum   (b) $a = -2$，極大值 maximum

(c) $a = 2$，極小值 minimum   (d) $a = 2$，極大值 maximum

(e) 以上皆非 None of the above

19.令 $f(x) = x^3 - 3x + 3$。下列敘述何者正確？

Let $f(x) = x^3 - 3x + 3$. Which of the following statements is correct?

(a) 其極大值為正, 極小值為負

　　The local maximum of $f(x)$ is positive and the local minimum is negative.

(b) 其極大值為負, 極小值為正

　　The local maximum of $f(x)$ is negative and the local minimum is positive.

(c) 極大值和極小值同為負

　　Both of the local maximum and local minimum of $f(x)$ are negative.

(d) 極大值和極小值同為正

　　Both of the local maximum and local minimum of $f(x)$ are positive.

(e) 以上皆非　None of the above

20.下列何者最接近 $\sqrt{\frac{10}{11}}$ ？

Which of the following numbers is the closest to $\sqrt{\frac{10}{11}}$?

(a) 0.912

(b) 0.930

(c) 0.953

(d) 0.971

(e) 以上皆非　None of the above

21.令 a,b,c 為一三角形的三邊邊長。假設 $ab + bc + ca = 2$ 並令 $A = a + b + c$。下列何者為正確？

Let a, b and c be the lengths of the sides of a triangle. Suppose that $ab + bc + ca = 2$, and $A = a + b + c$. Which of the following is correct?

(a) $1 \leq A < \sqrt{5}$

(b) $\sqrt{2} \leq A < \sqrt{6}$

(c) $\sqrt{6} \leq A < \sqrt{10}$

(d) $\sqrt{10} < A < \sqrt{15}$

(e) 以上皆非　None of the above

22.三邊邊長爲整數，且其最長邊的邊長是 10 的三角形有幾個？

How many different triangles are there with the lengths of the sides being integers, and the longest one being 10?

(a) 25

(b) 30

(c) 40

(d) 55

(e) 以上皆非 None of the above

23.現有四種顏色的球，每種顏色各兩個，將其排成一列。如果同樣顏色的球不能放在一起，可有幾種排列方式？

There are 8 balls in four different colors, with two balls in each color. If they are to be placed in a row, and no two of the same color are placed next to each other, how many ways can it be done?

(a) 320

(b) 482

(c) 576

(d) 864

(e) 以上皆非 None of the above

24.令 m 及 n 爲正整數。如果 $\dfrac{m+n}{m^2+mn+n^2}=\dfrac{2}{13}$ ，則下列何者爲 $m+n$？

Let m and n be positive integers. If $\dfrac{m+n}{m^2+mn+n^2}=\dfrac{2}{13}$, what could be $m+n$?

(a) 6

(b) 7

(c) 8

(d) 9

(e) 以上皆非 None of the above

25.令 $x_1=3$ ，且當 $n\geq 1$ 時 $x_{n+1}=x_n^2-2$。則 $\lim_{n\to\infty}\dfrac{x_{n+1}}{x_1 x_2 \cdots x_n}$ 爲？

Let $x_1=3$, and $x_{n+1}=x_n^2-2$ for $n\geq 1$. Then $\lim_{n\to\infty}\dfrac{x_{n+1}}{x_1 x_2 \cdots x_n}$ is?

(a) $\sqrt{5}$　　(b) $\sqrt{6}$　　(c) $\sqrt{7}$　　(d) $\sqrt{8}$　　(e) 以上皆非 None of the above