Financial Mathematics

Clicker review session, Midterm 01

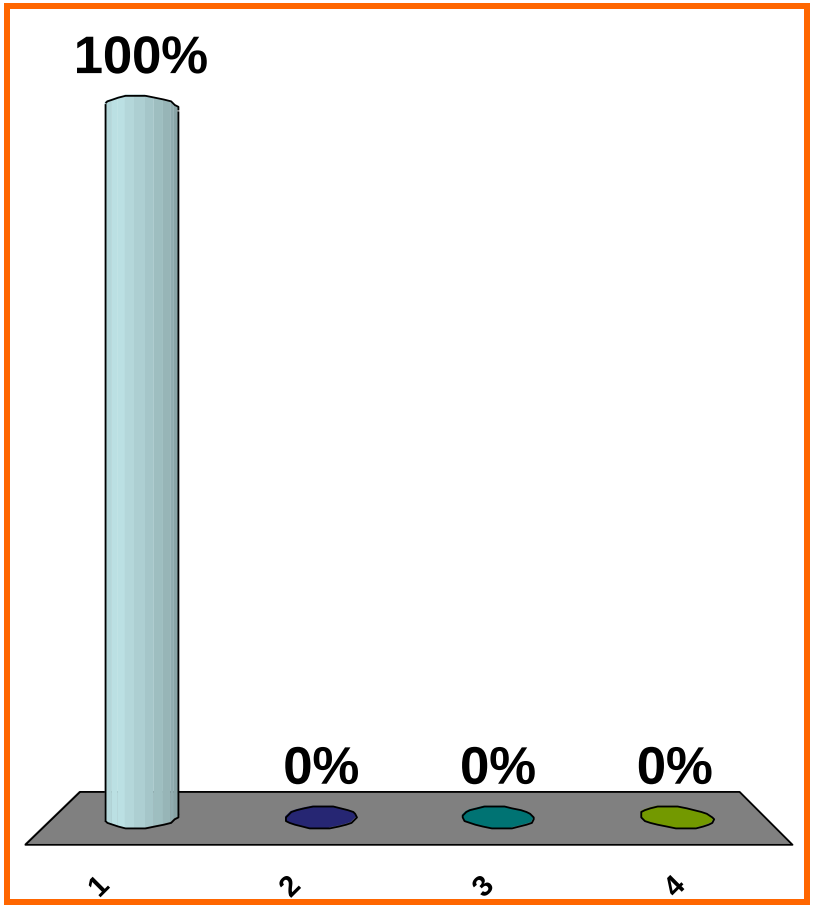
$1 + 1 =$

(a) 2

(b) 3

(c) 4

(d) 5



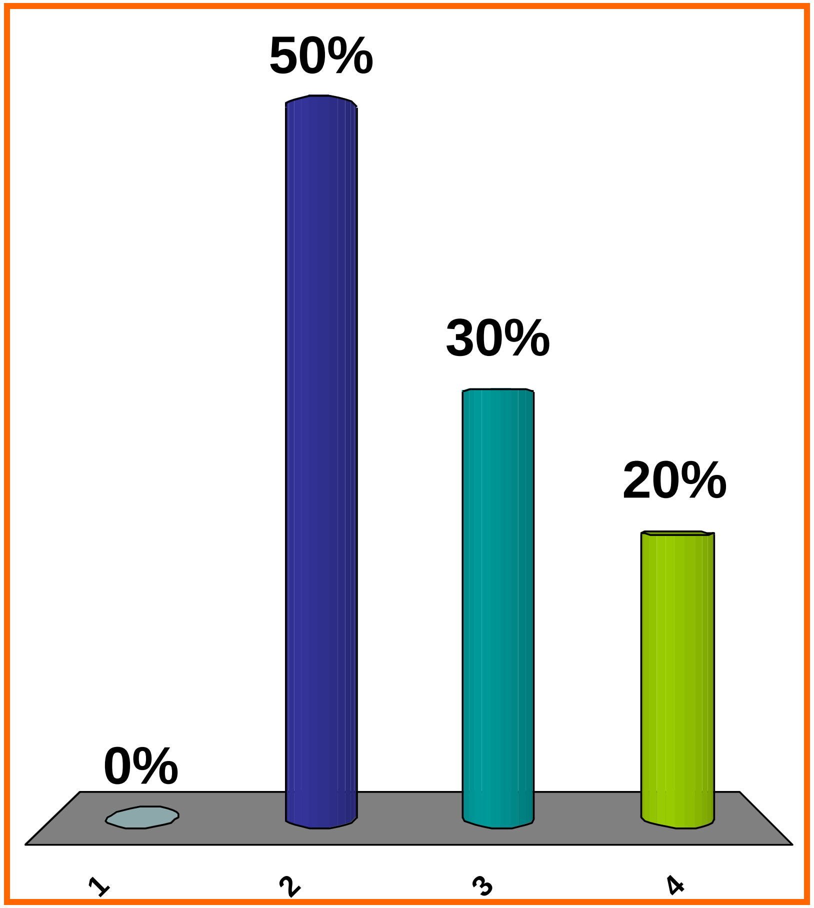
Boundary of $[2,3] \times [4,5]$ in $\mathbb{R}^2$

(a) $\{2\}$

(b) $\{2,3\} \times [4,5] \cup [2,3] \times \{4,5\}$

(c) $\{2,3\} \times \{4,5\}$

(d) none of the above



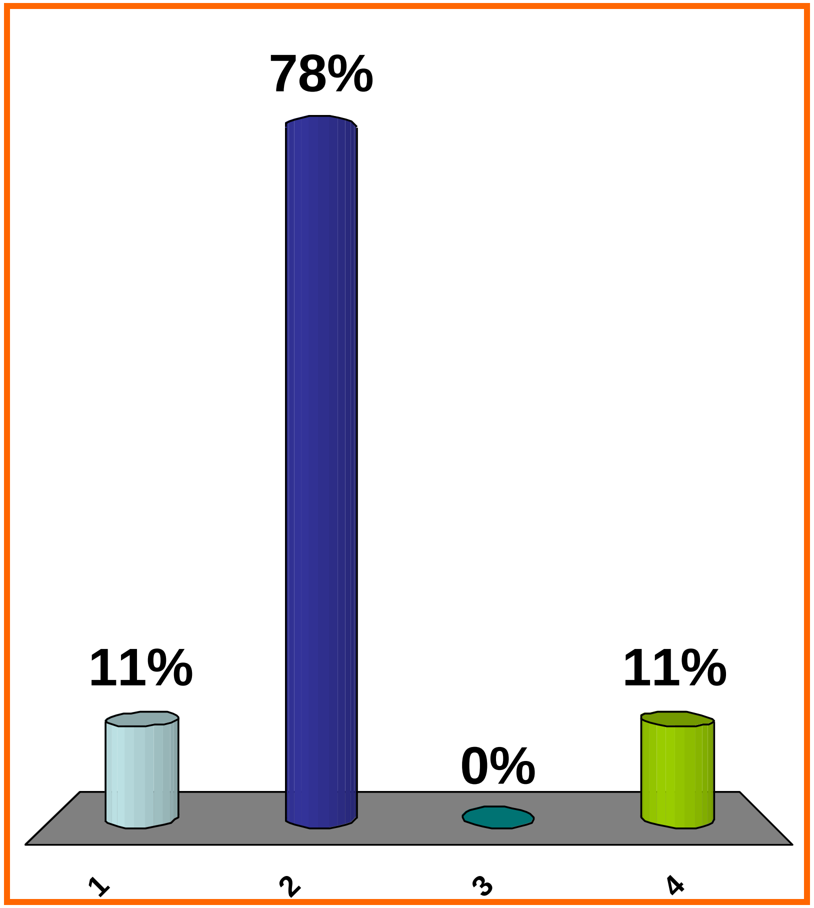
Boundary of $[2,3) \times (4,5)$ in $\mathbb{R}^2$

(a) $\{2\}$

$\boxed{\text{(b)}}$ $\{2,3\} \times [4,5] \cup [2,3] \times \{4,5\}$

(c) $\{2,3\} \times \{4,5\}$

(d) none of the above



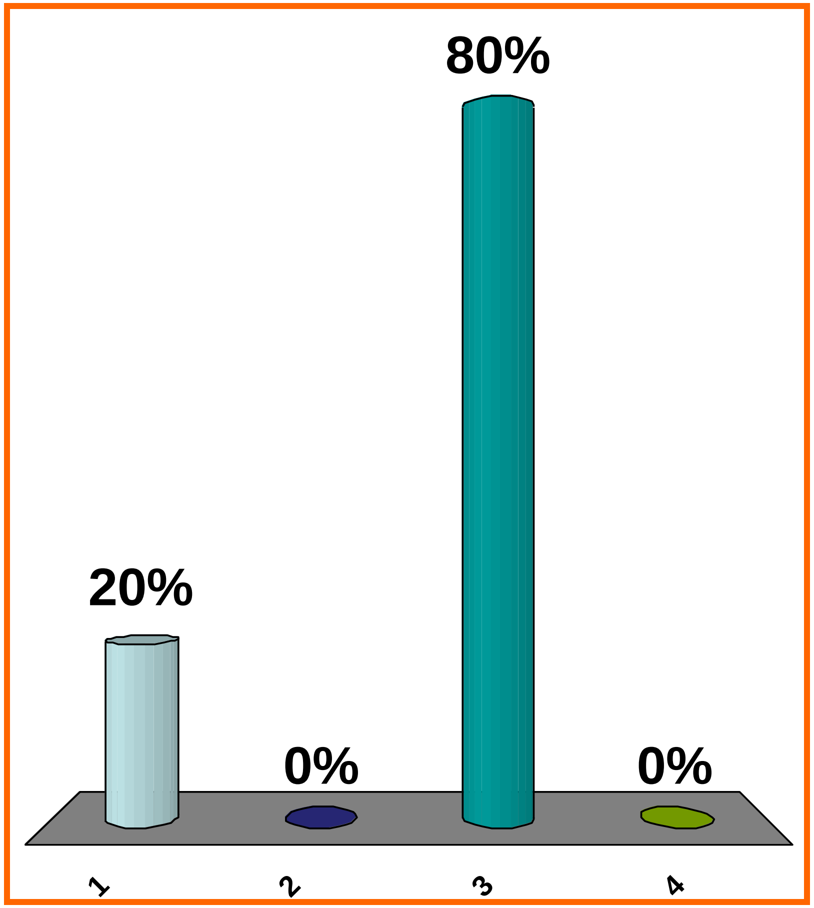
Boundary of $(1,\infty)\times[4,5)$ in $\mathbb{R}^2$

(a) $\{1\}\times\{4,5\}$

(b) $$\{1\}\times[4,5) \cup [1,\infty)\times\{4,5\}$$

(c) $$\{1\}\times[4,5] \cup [1,\infty)\times\{4,5\}$$

(d) none of the above



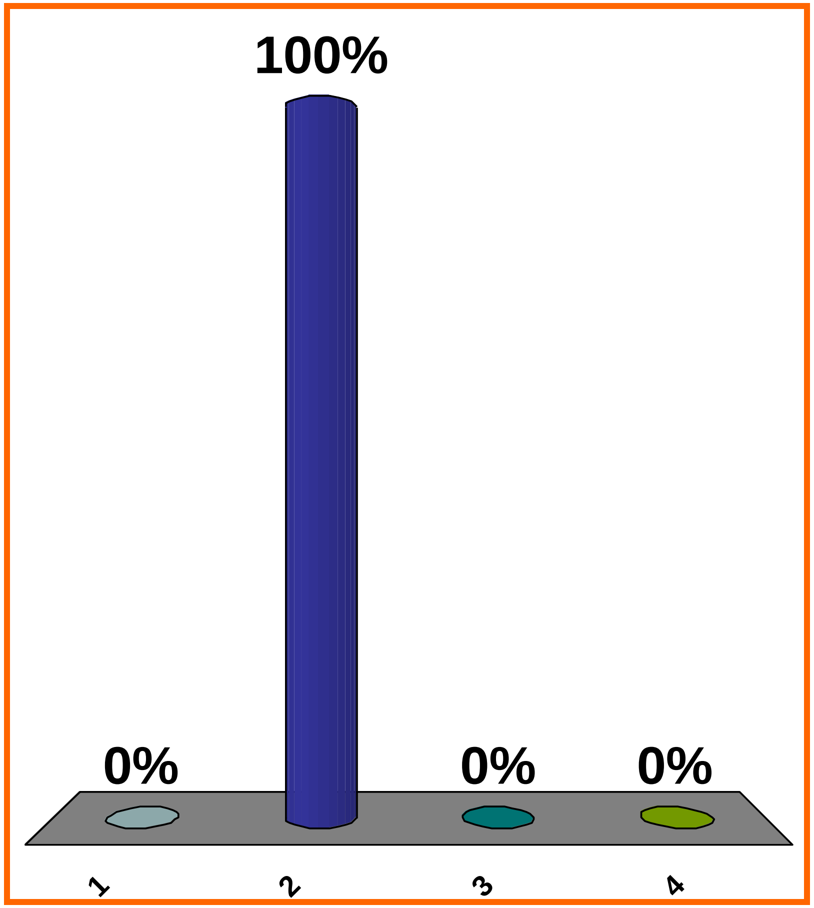
To eliminate the linear term in
$-(x^2/2) + 5x + 7$
replace x by $x + \cdots$

(a) $-1/2$

(b) 5

(c) 7

(d) none of the above



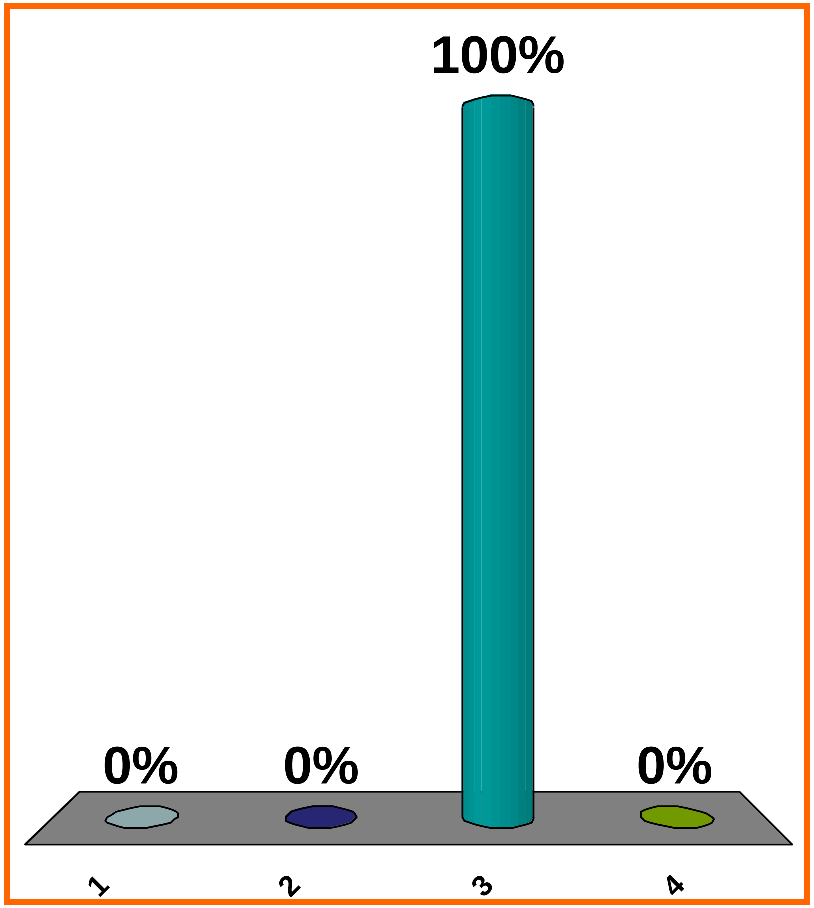
To eliminate the linear term in $-(x^2/2)+4x+3$ replace x by $x+\cdots$

(a) $-1/2$

(b) 3

(c) 4

(d) none of the above



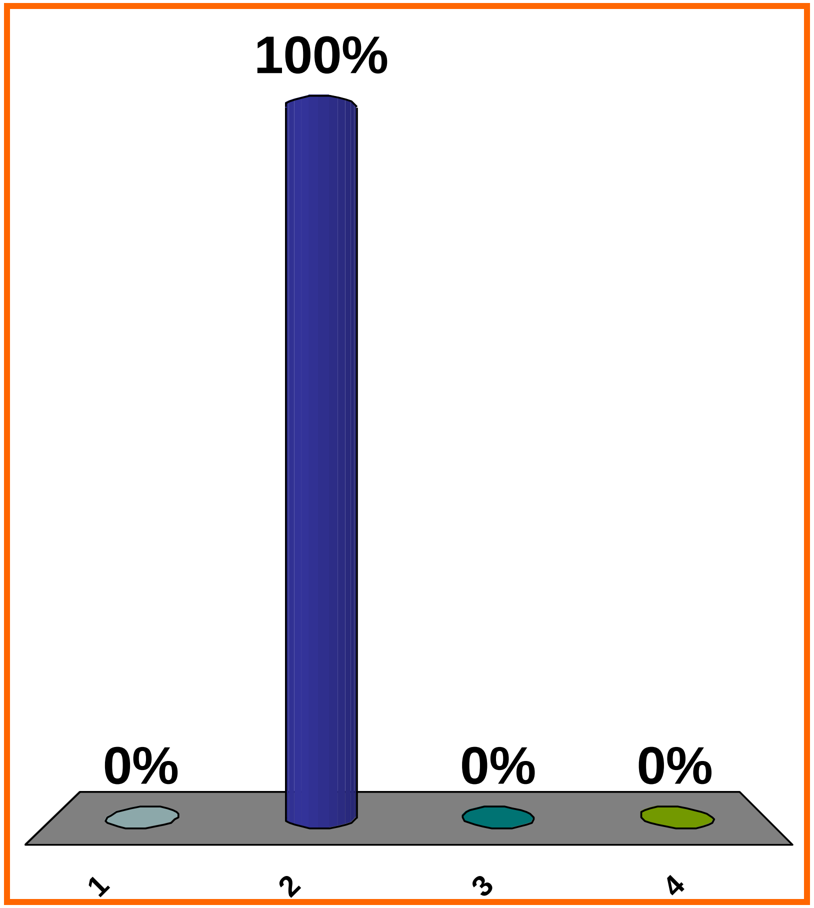
To eliminate the linear term in $-(x^2/2) - 9x + 15$ replace x by $x + \cdots$

(a) 15

$\boxed{\text{(b)}}$ -9

(c) $-1/2$

(d) none of the above



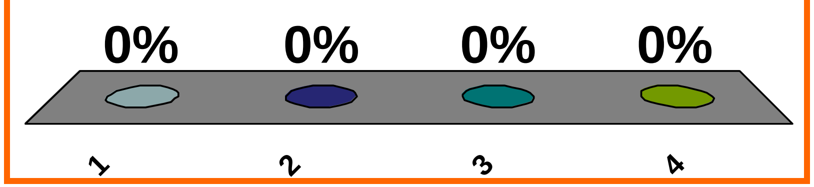
To eliminate the linear term in
$$\boxed{-x^2} - 9x + 15$$
replace x by $x + \cdots$

(a) 15

(b) -9

(c) $-1/2$

(d) none of the above
$-9/2$



0 of 5

Eliminate the linear term in $-(x^2/2) + 5x + 7$

(a) $-(x^2/2) + 7$

(b) $-(x^2/2) + 5 + 7$

$\boxed{\text{(c)}}$ $-(x^2/2) + (25/2) + 7$

(d) none of the above

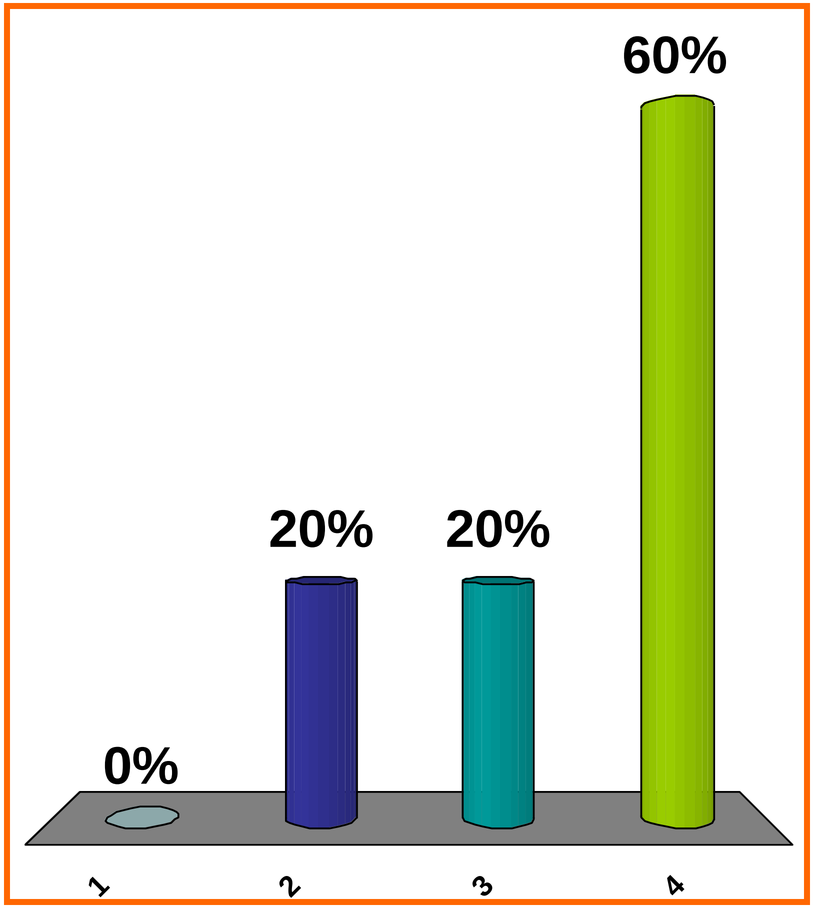
Eliminate the linear term in $-(x^2/2) + 4x + 3$

(a) $-(x^2/2) + 3$

(b) $-(x^2/2) + 16 + 3$

(c) $-(x^2/2) + 4 + 3$

(d) none of the above
$-(x^2/2) + 8 + 3$



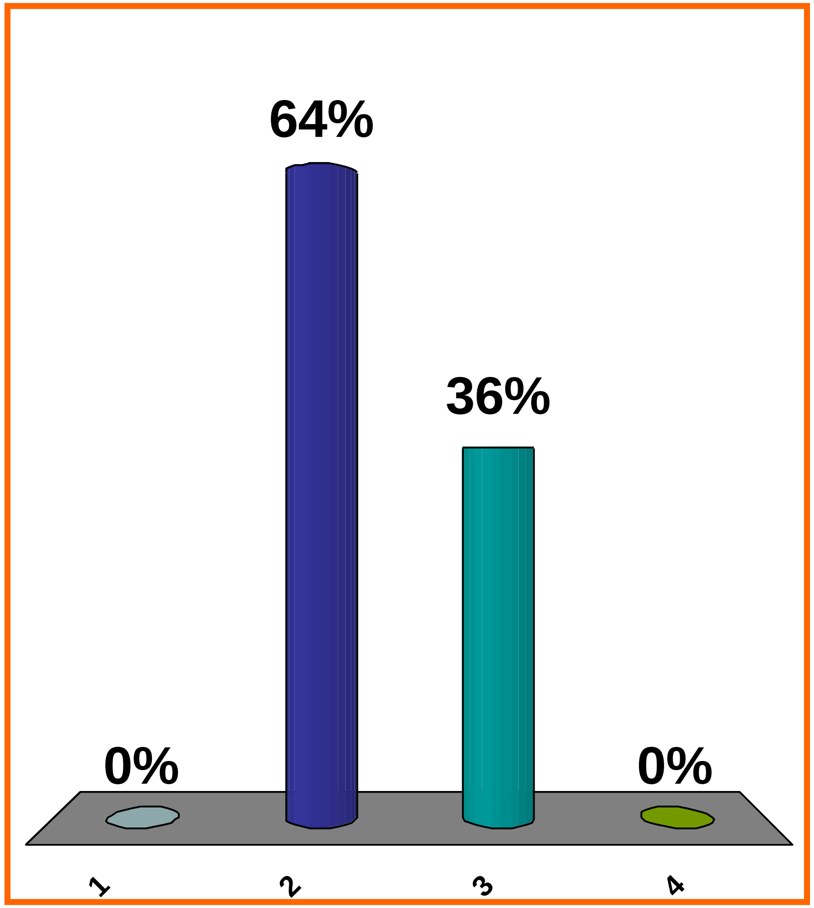
Eliminate the linear term in $-(x^2/2) - 9x + 15$

(a) $-(x^2/2) + 15$

(b) $-(x^2/2) + (81/2) + 15$

(c) $-(x^2/2) - (81/2) + 15$

(d) none of the above



Eliminate the linear term in $\boxed{-x^2} - 9x + 15$

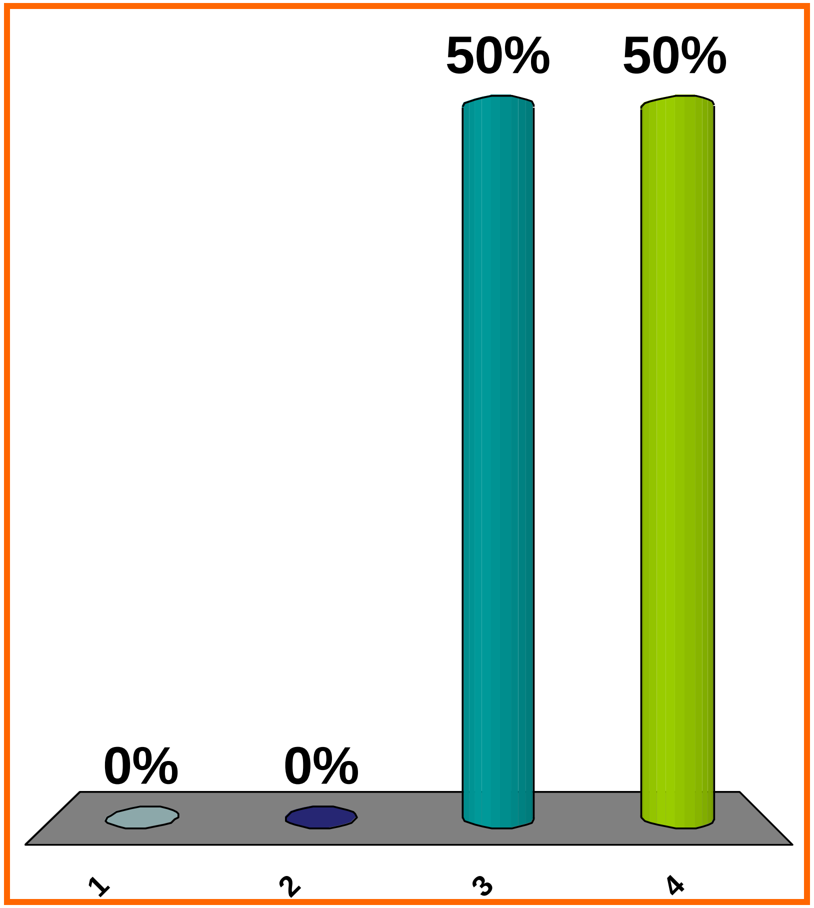
(a) $2[-(x^2/2) + (15/2)]$

(b) $2[-(x^2/2) + 81 + (15/2)]$

(c) $2[-(x^2/2) + (81/2) + (15/2)]$

(d) none of the above

$2[-(x^2/2) + (81/8) + (15/2)]$



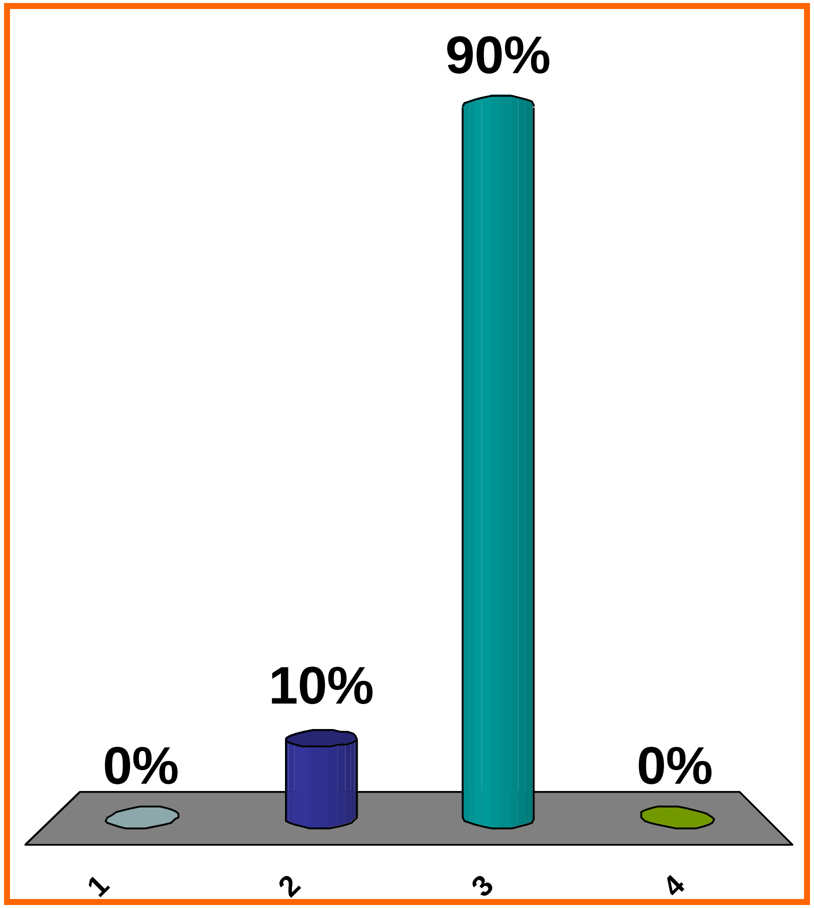
Eliminate the linear term in $3x^2 - 24x + 42$

(a) $-6[-(x^2/2) - 7]$

(b) $-6[-(x^2/2) + 16 - 7]$

(c) $-6[-(x^2/2) + 8 - 7]$

(d) none of the above



$$\binom{25}{5}$$

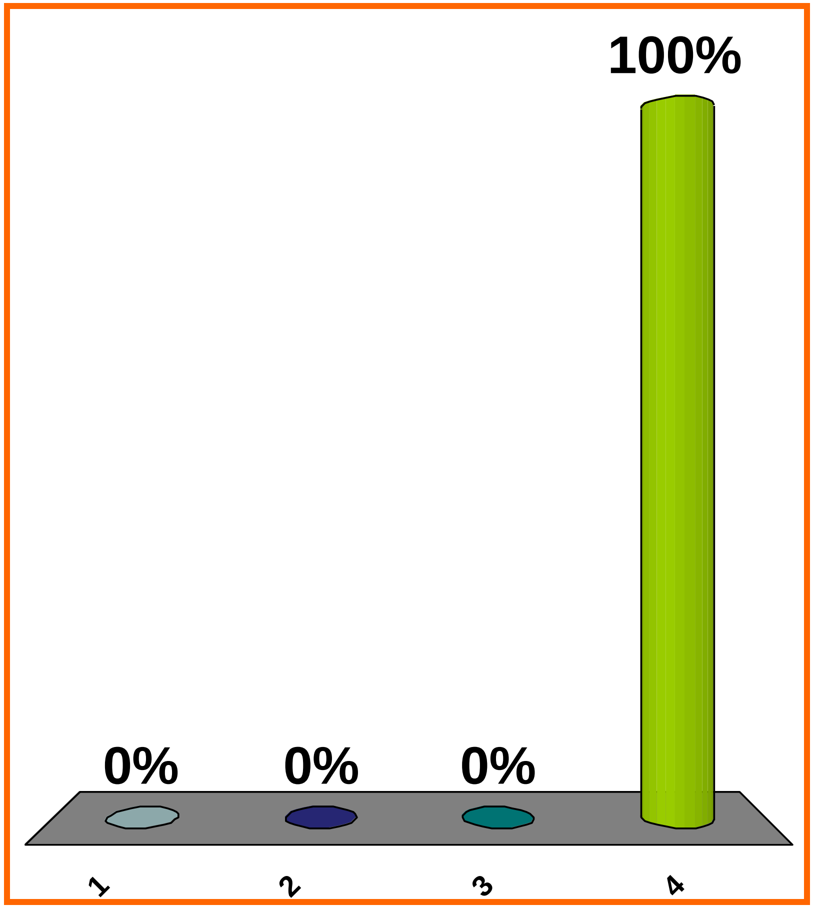
(a) $\dfrac{(5!)(20!)}{25!}$

(b) $\dfrac{5!}{25!}$

(c) $\dfrac{25!}{5!}$

(d) none of the above

$$\frac{25!}{(5!)(20!)}$$



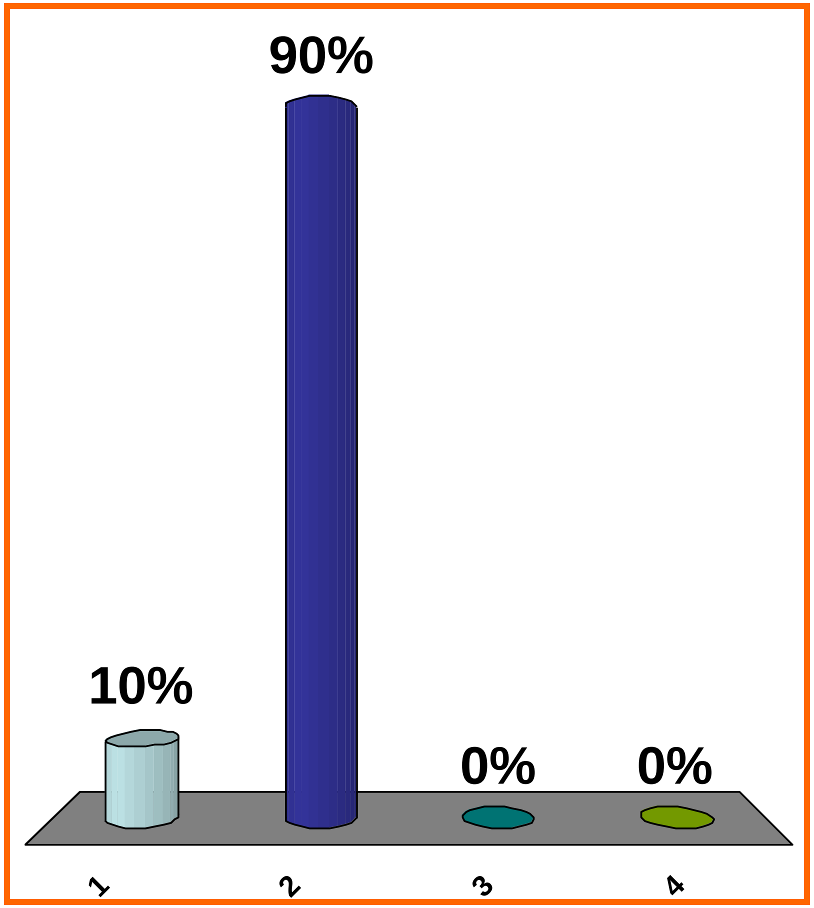
$$\binom{15}{3}$$

(a) $\dfrac{(15)(14)(13)(12)}{(3)(2)(1)}$

(b) $\dfrac{(15)(14)(13)}{(3)(2)(1)}$

(c) 5

(d) none of the above



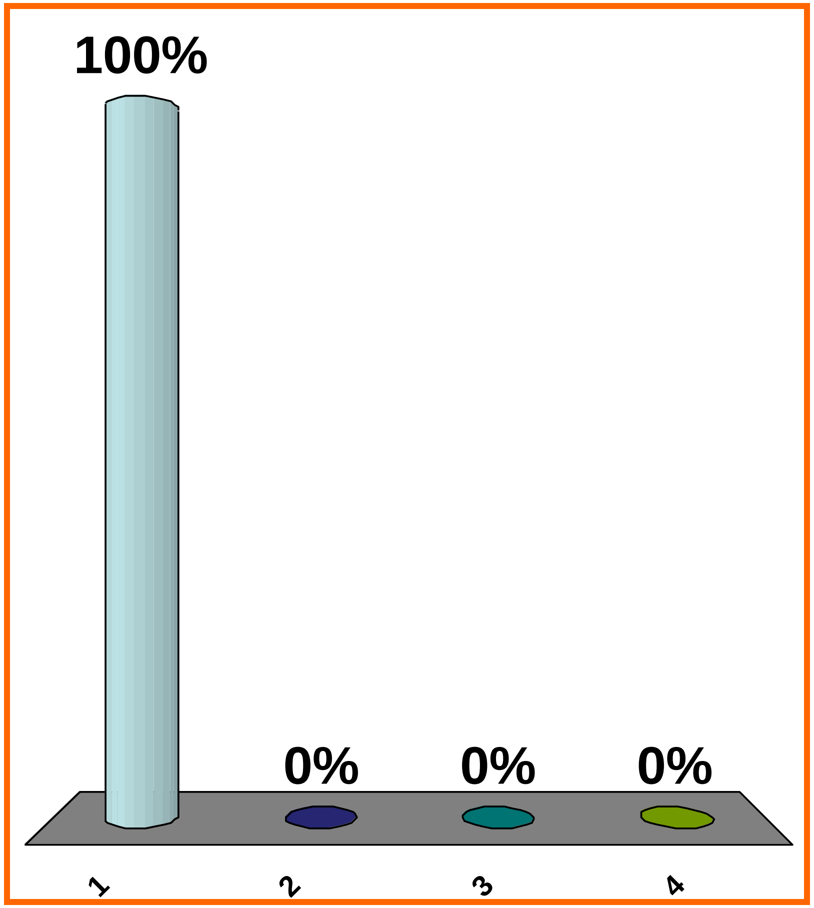
$$\binom{17}{6}$$

(a) $\boxed{}$ $\dfrac{17!}{(6!)(11!)}$

(b) $11!$

(c) $\dfrac{17!}{6!}$

(d) none of the above



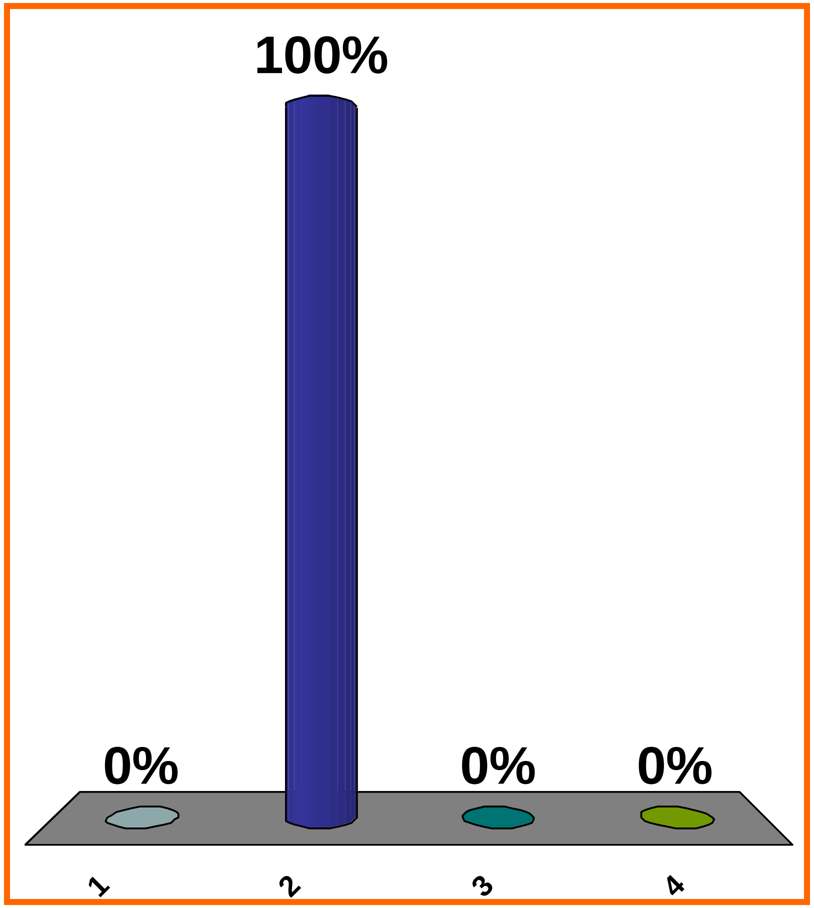
#monomials degree ≤ 7 in 8 variables

(a) $\binom{8}{7}$

(b) $\binom{15}{7}$

(c) $\binom{15}{8-7}$

(d) none of the above



#monomials
degree ≤ 6 in 8 variables

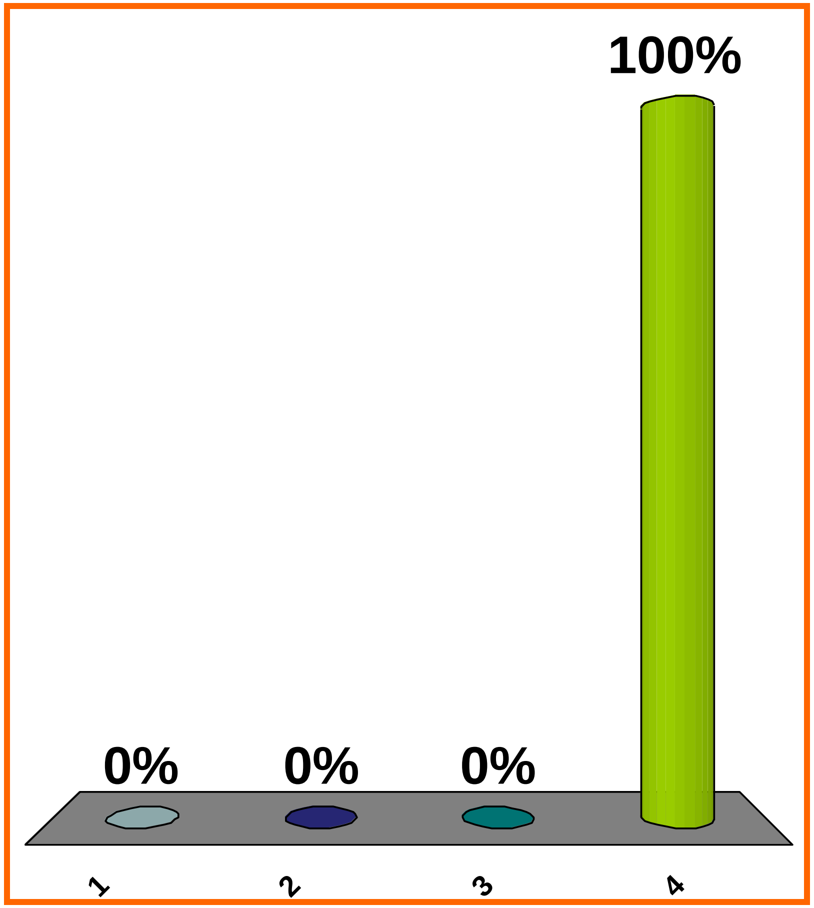
(a) $\binom{13}{6}$

(b) $\binom{14}{4}$

(c) $\binom{14}{7}$

(d) none of the above

$$\binom{14}{6} = \binom{14}{8}$$



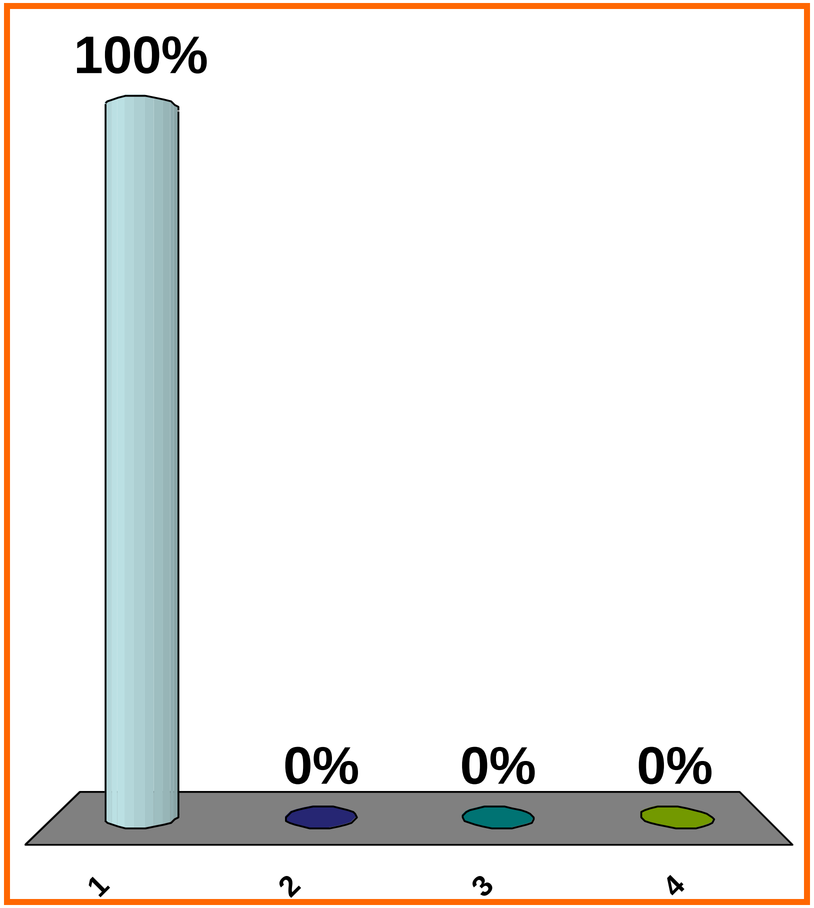
#monomials
degree = 6 in 8 variables

(a) $\binom{13}{6}$

(b) $\binom{14}{4}$

(c) $\binom{14}{7}$

(d) none of the above



(a) $\binom{10}{6}$

(b) $\binom{10}{5}$

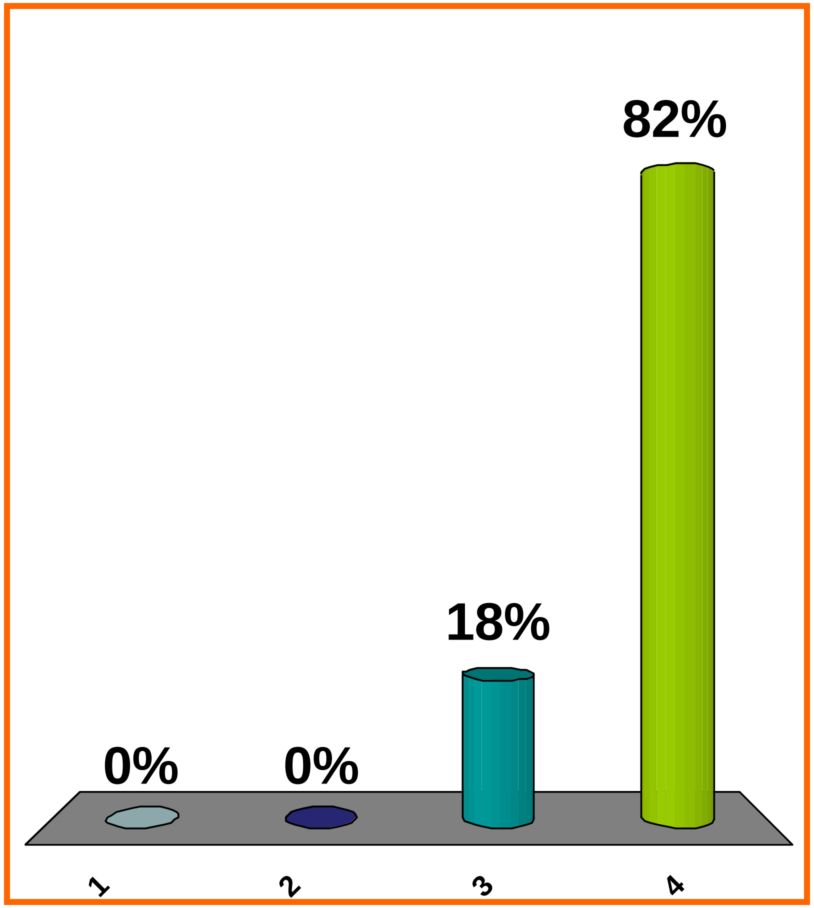
(c) $\binom{9}{4}$

(d) none of the above

$$\binom{9}{3} = \binom{9}{6}$$

#monomials

degree $= 6$ in 4 variables



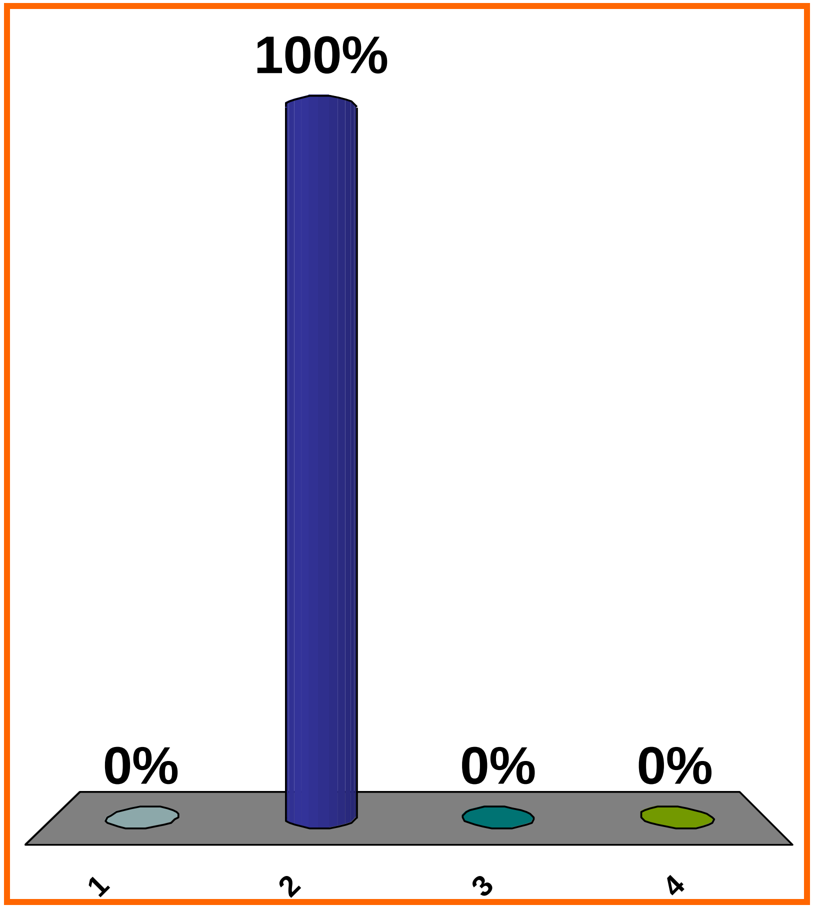
(a) $\binom{7}{5}$

(b) $\binom{12}{5}$

(c) $(5)(7)$

(d) none of the above

$\#\{$monomials of degree ≤ 5 in 7 variables$\}$



(a) $\binom{22}{10}$

(b) $\binom{10}{22}$

$\boxed{\text{(c) } \binom{32}{10}}$

(d) none of the above

$\#\{\text{monomials of degree} \leq 10 \text{ in 22 variables}\}$

$$\#\{\text{monomials of degree} = 10 \text{ in 22 variables}\}$$

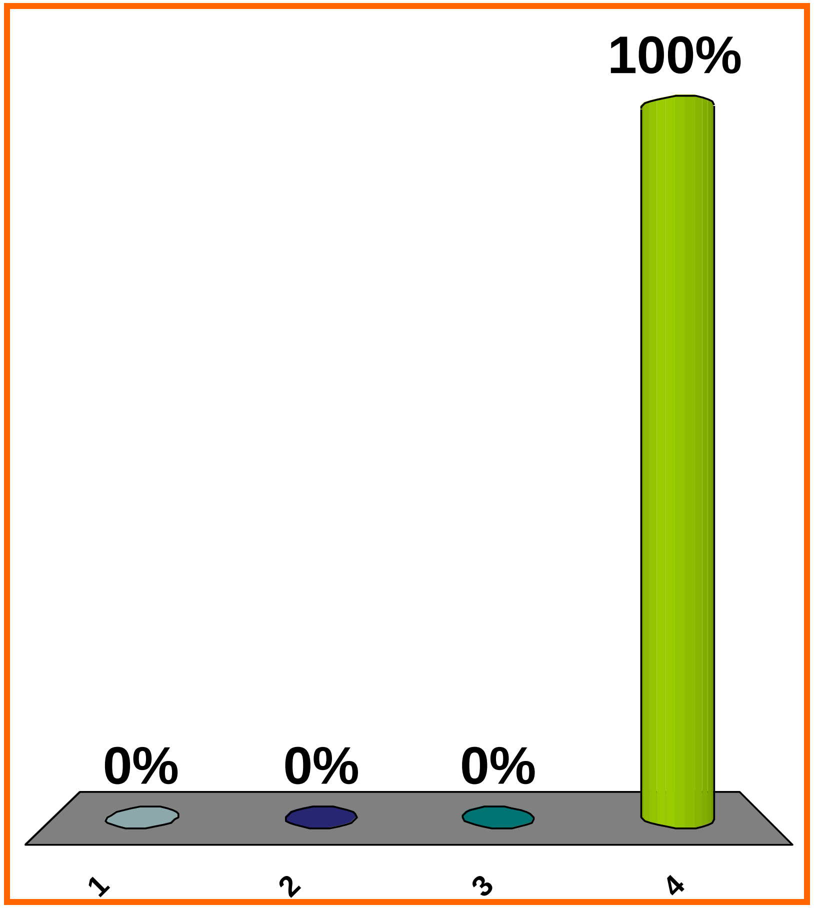
(a) $\binom{22}{10}$

(b) $\binom{10}{22}$

(c) $\binom{32}{10}$

$$\binom{31}{10} = \binom{31}{21}$$

(d) none of the above



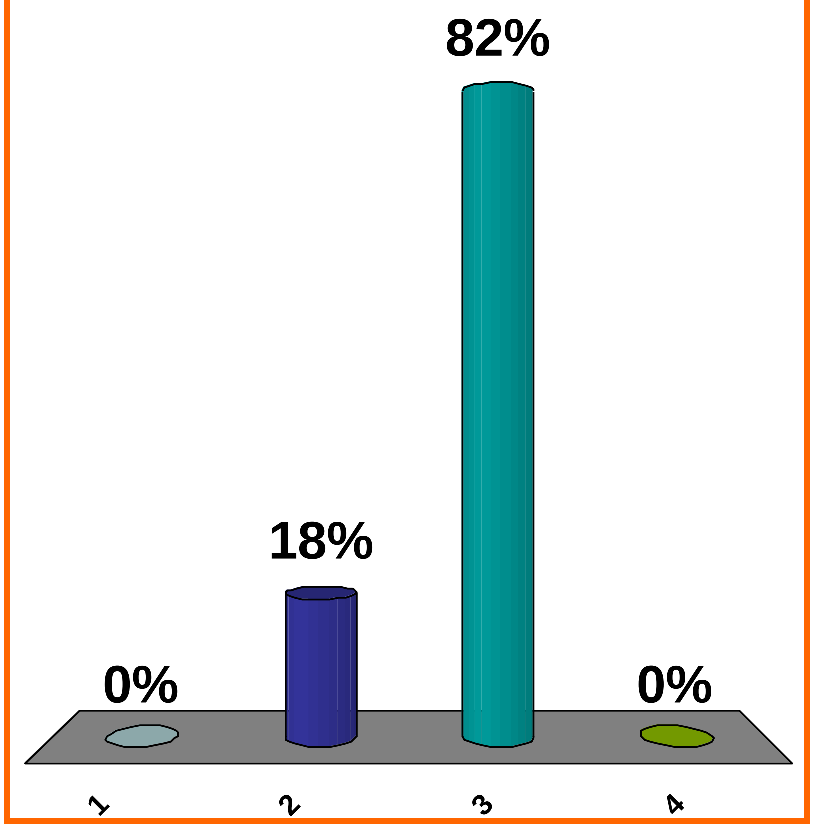
$$f'''(x) \le 30$$
$$f(0) = f'(0) = f''(0) = 0$$
Inequality for $f(2)$?

(a) $f(2) \ge 30(2^3)$

(b) $f(2) \ge 5(2^3)$

$\boxed{\text{(c)}}$ $f(2) \le 5(2^3)$

(d) none of the above



$$f'''(x) \geq 30$$

$$f(0) = f'(0) = f''(0) = 0$$

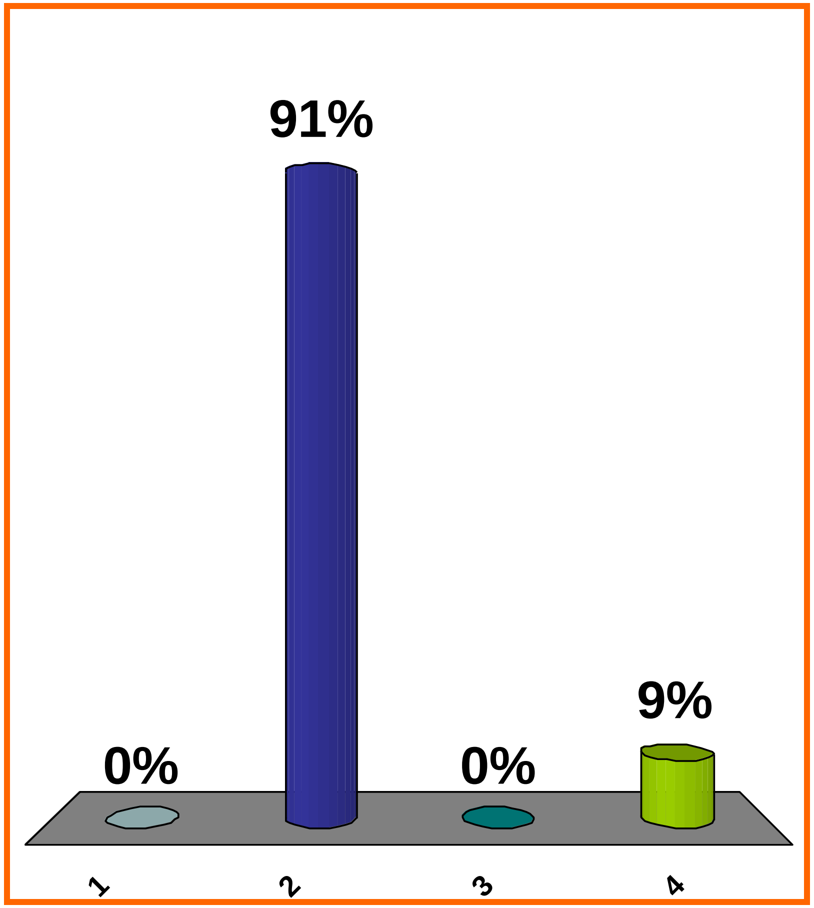
Inequality for $f(2)$?

(a) $f(2) \geq 30(2^3)$

$\boxed{\text{(b)}}$ $f(2) \geq 5(2^3)$

(c) $f(2) \leq 5(2^3)$

(d) none of the above



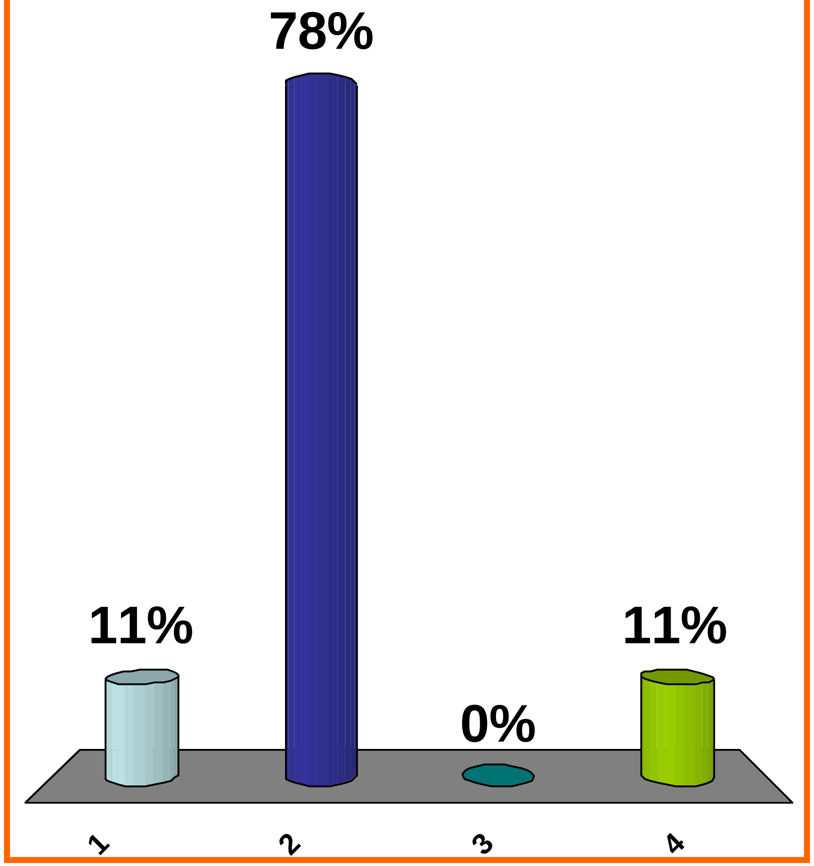
$$f'''(x) \leq 30$$
$$f(0) = f'(0) = f''(0) = 0$$
Inequality for $f(-2)$?

(a) $f(-2) \leq 5((-2)^3)$

(b) $f(-2) \geq 5((-2)^3)$

(c) $f(-2) \geq 30((-2)^3)$

(d) none of the above



$$f'''(x) \geq 30$$

$$f(0) = f'(0) = f''(0) = 0$$

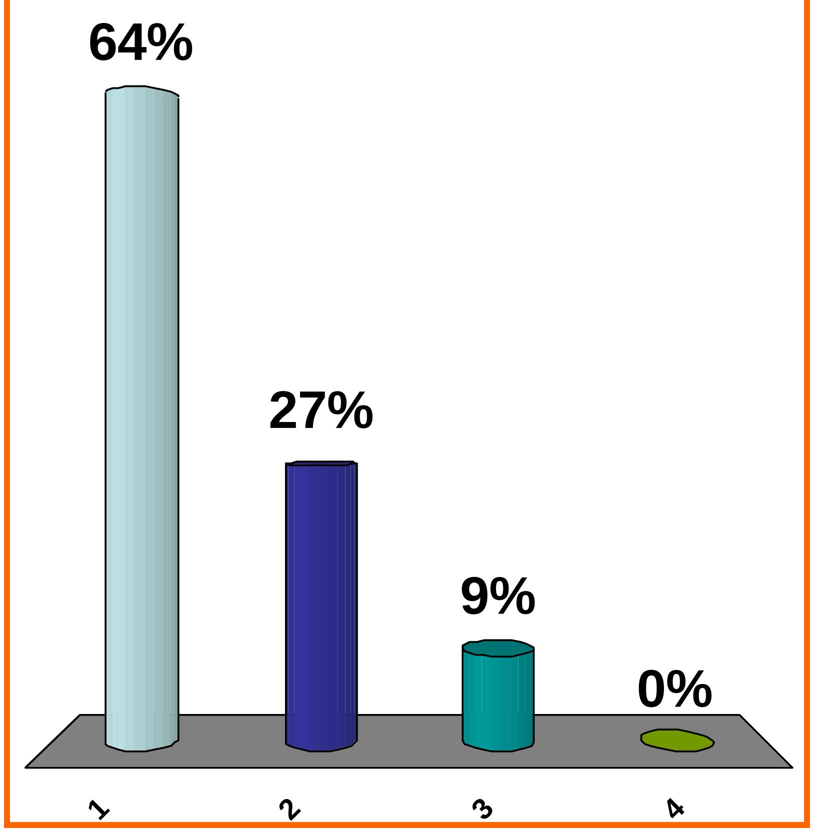
Inequality for $f(-2)$?

(a) $f(-2) \leq 5((-2)^3)$

(b) $f(-2) \geq 5((-2)^3)$

(c) $f(-2) \geq 30((-2)^3)$

(d) none of the above



$$f''''(x) \le 24$$

$$f(0) = f'(0) = f''(0) = f'''(0) = 0$$

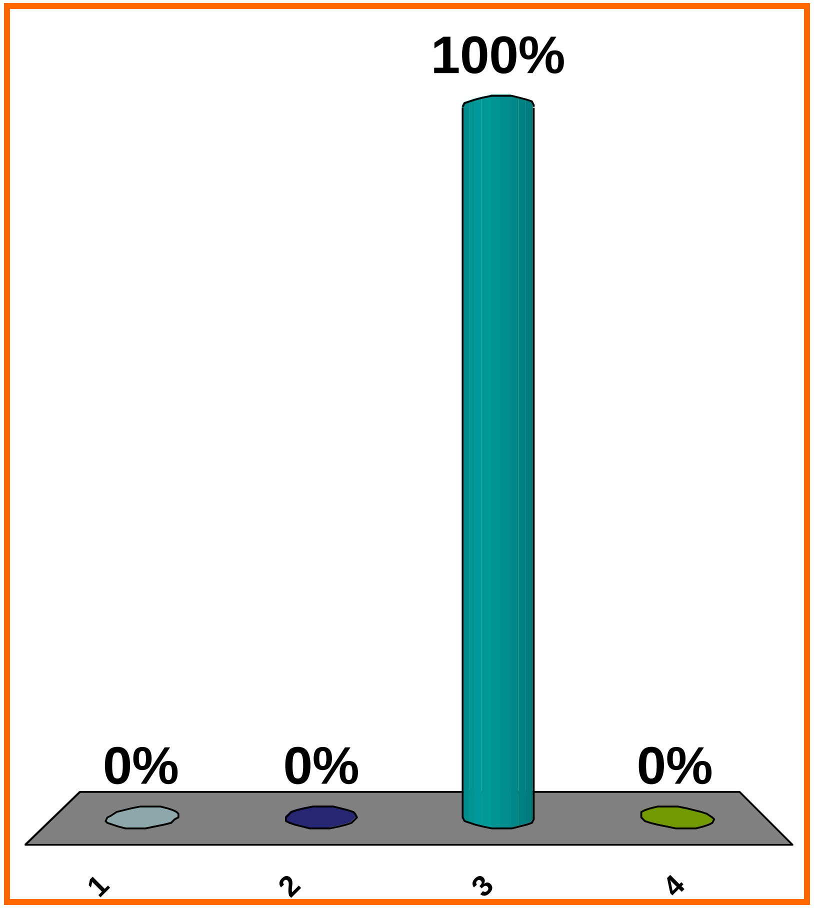
Inequality for $f(2)$?

(a) $f(2) \ge 24(2^4)$

(b) $f(2) \ge 2^4$

(c) $f(2) \le 2^4$

(d) none of the above



$$f''''(x) \geq 24$$

$$f(0) = f'(0) = f''(0) = f'''(0) = 0$$

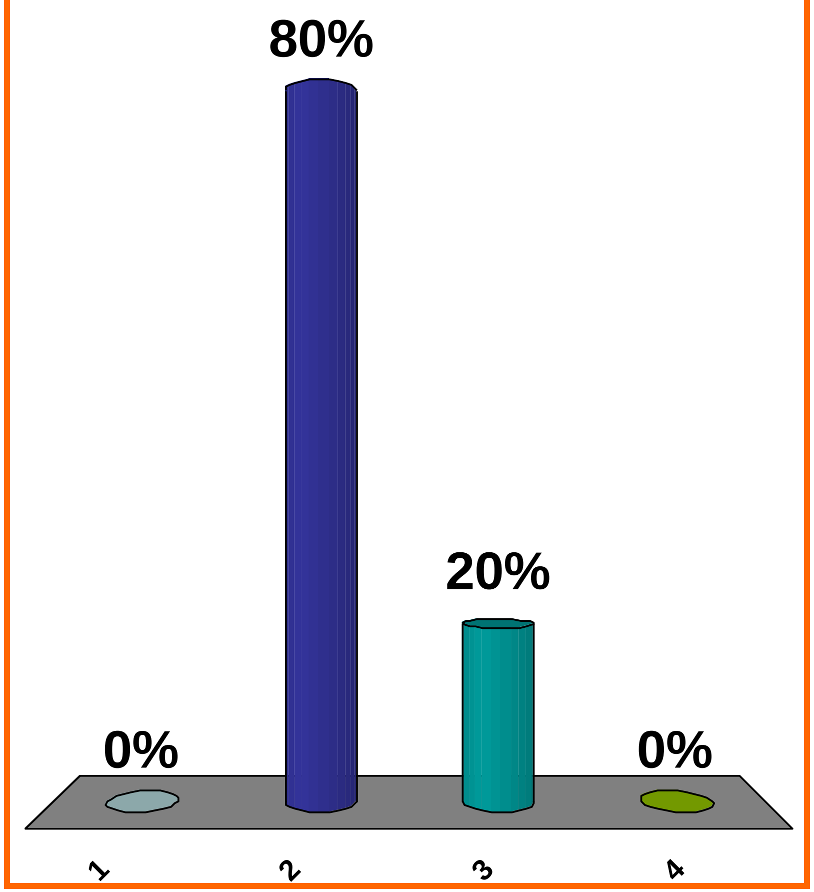
Inequality for $f(2)$?

(a) $f(2) \geq 24(2^4)$

(b) $f(2) \geq 2^4$

(c) $f(2) \leq 2^4$

(d) none of the above



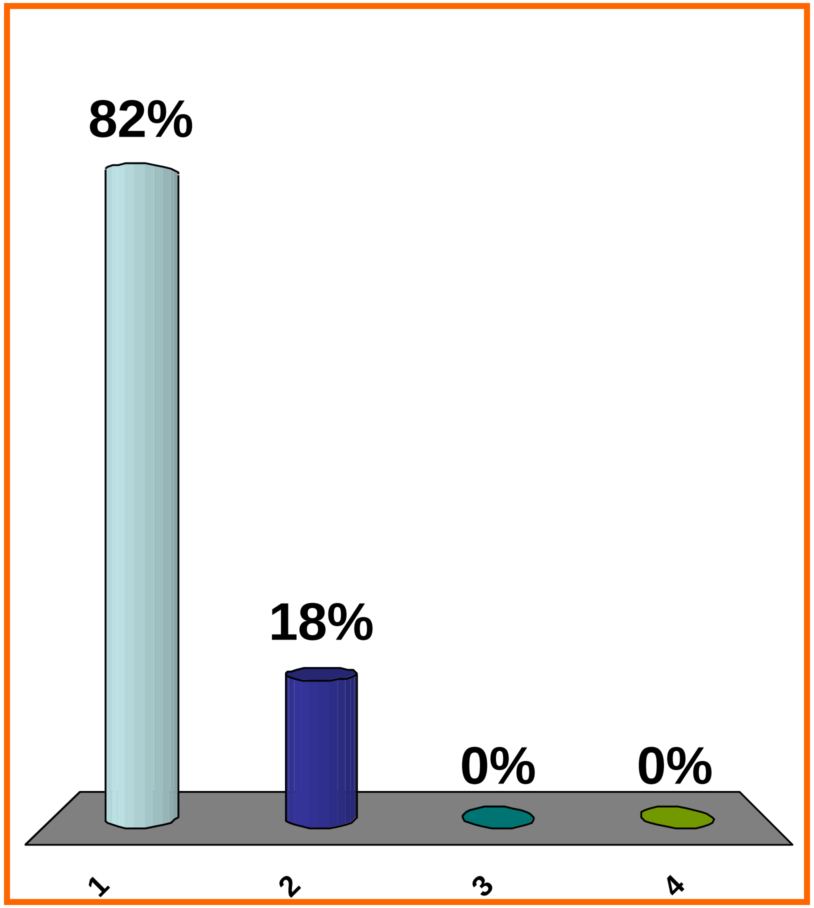
$$f''''(x) \le 24$$
$$f(0) = f'(0) = f''(0) = f'''(0) = 0$$
Inequality for $f(-2)$?

(a) $f(-2) \le (-2)^4$

(b) $f(-2) \ge (-2)^4$

(c) $f(-2) \ge 24((-2)^4)$

(d) none of the above



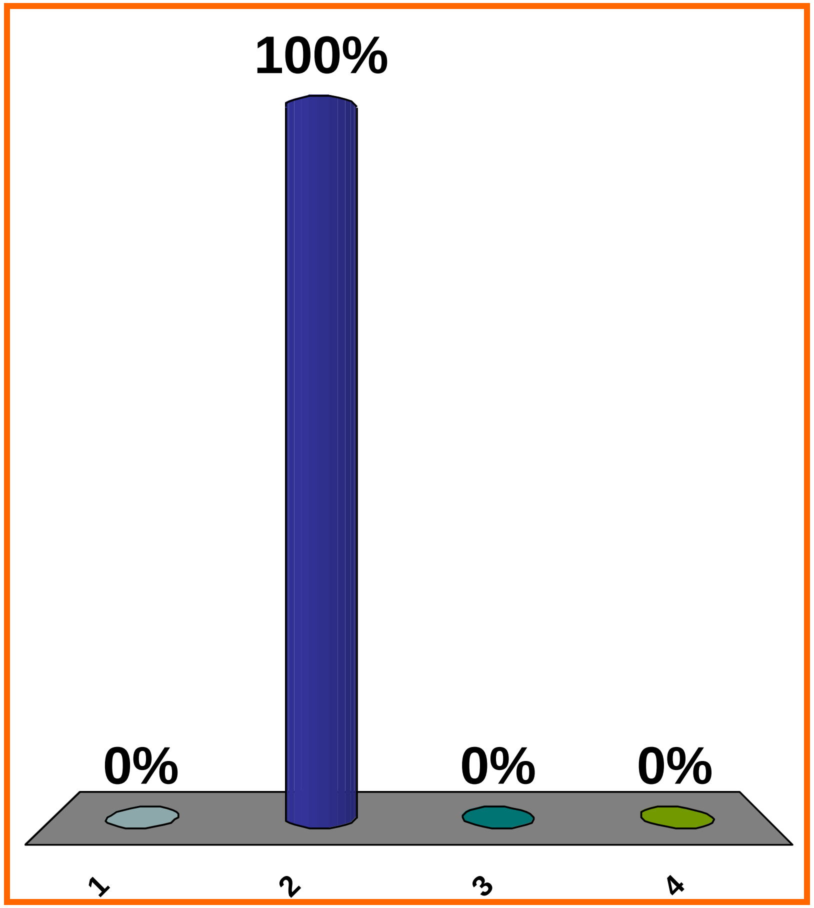
$$f''''(x) \geq 24$$
$$f(0) = f'(0) = f''(0) = f'''(0) = 0$$
Inequality for $f(-2)$?

(a) $f(-2) \leq (-2)^4$

$\boxed{\text{(b)}}$ $f(-2) \geq (-2)^4$

(c) $f(-2) \geq 24((-2)^4)$

(d) none of the above



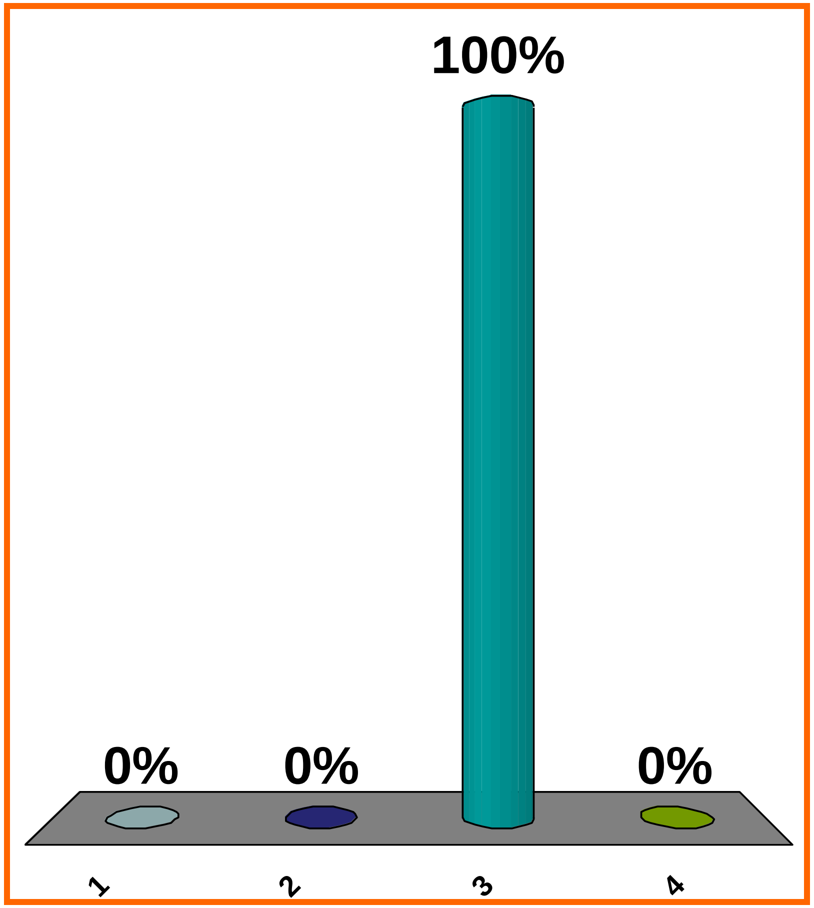
$$\frac{d}{dx}[x^{3x+1}] = ??$$

(a) 1

(b) $\frac{d}{dx}[(3x+1)(\ln x)]$

(c) $[x^{3x+1}]\left[\frac{d}{dx}[(3x+1)(\ln x)]\right]$

(d) none of the above



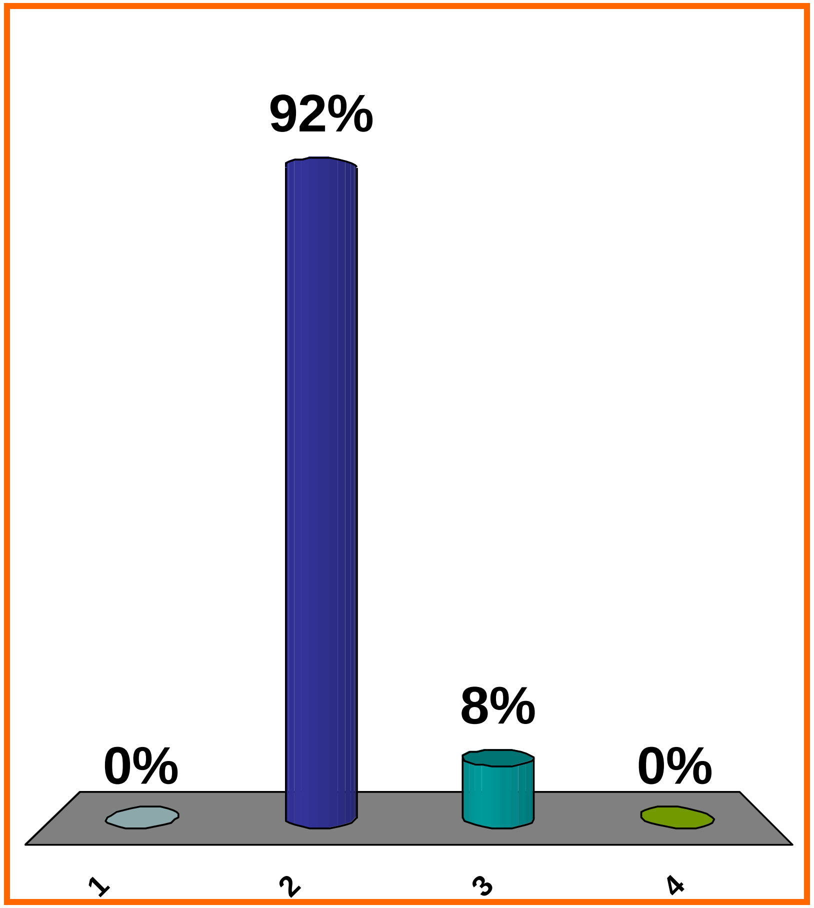
$$\frac{d}{dx}[(\cos x)^{\sin x}] = ??$$

(a) $(-\sin x)^{\cos x}$

$\boxed{\text{(b)}}$ $(\cos x)^{\sin x} \times \frac{d}{dx}[(\sin x)(\ln(\cos x))]$

(c) $\frac{d}{dx}[(\sin x)(\ln(\cos x))]$

(d) none of the above



$$e^{\pi i} = ??$$

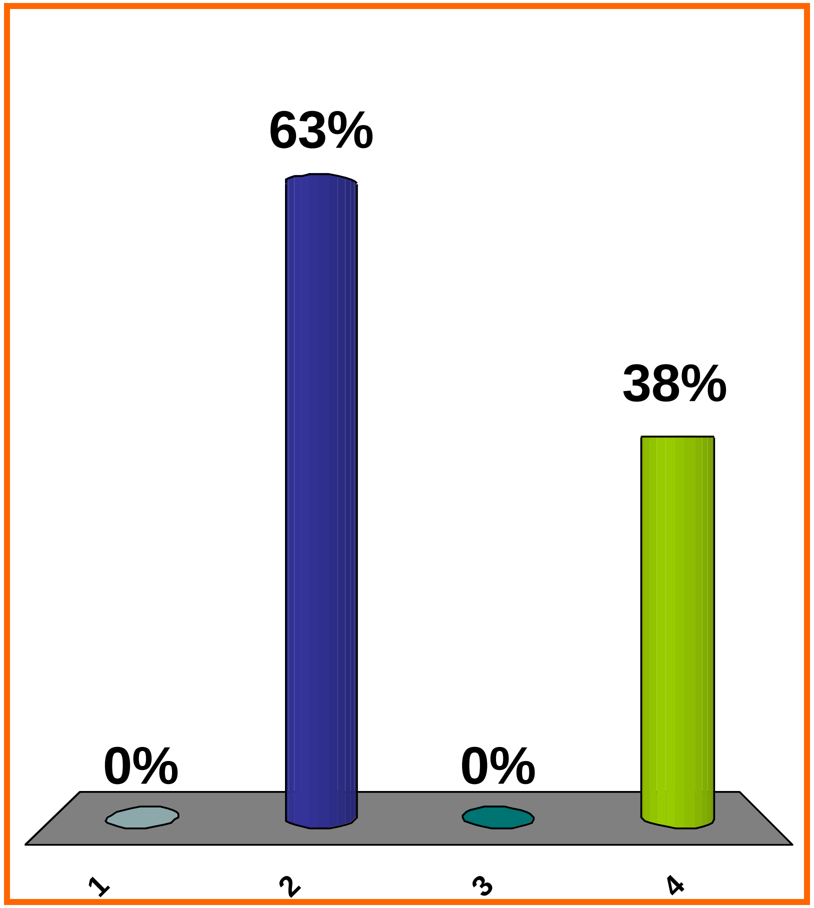
(a) 0

(b) 1

(c) 2

(d) none of the above

$$-1$$



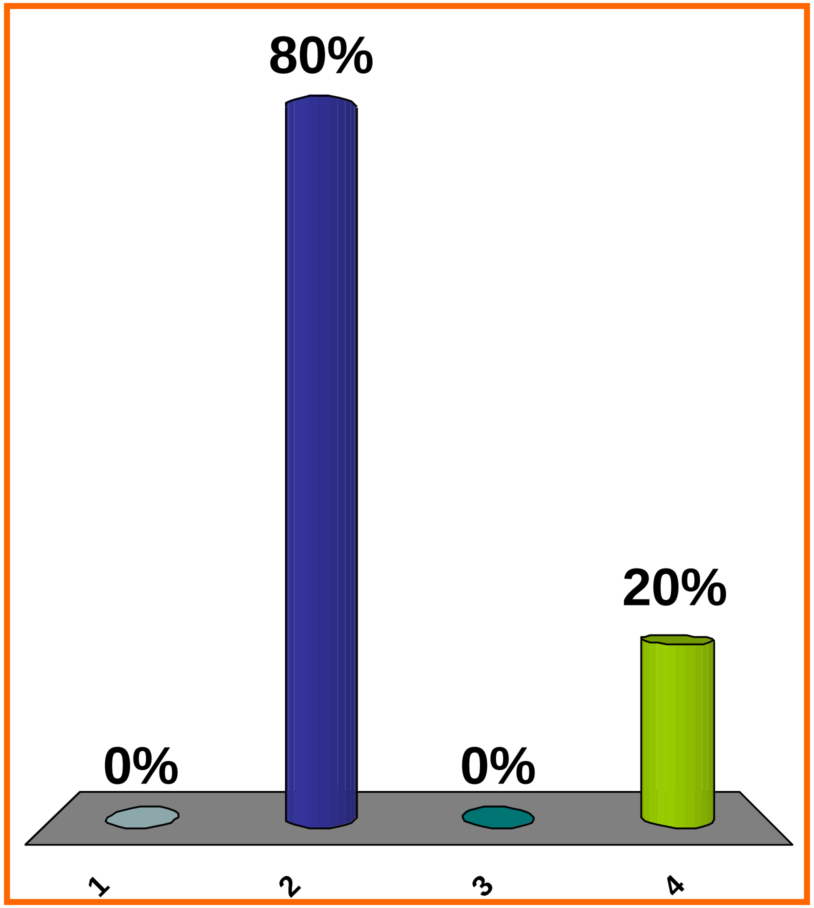
(a) 0

$$e^{2\pi i} = ??$$

(b) 1

(c) 2

(d) none of the above



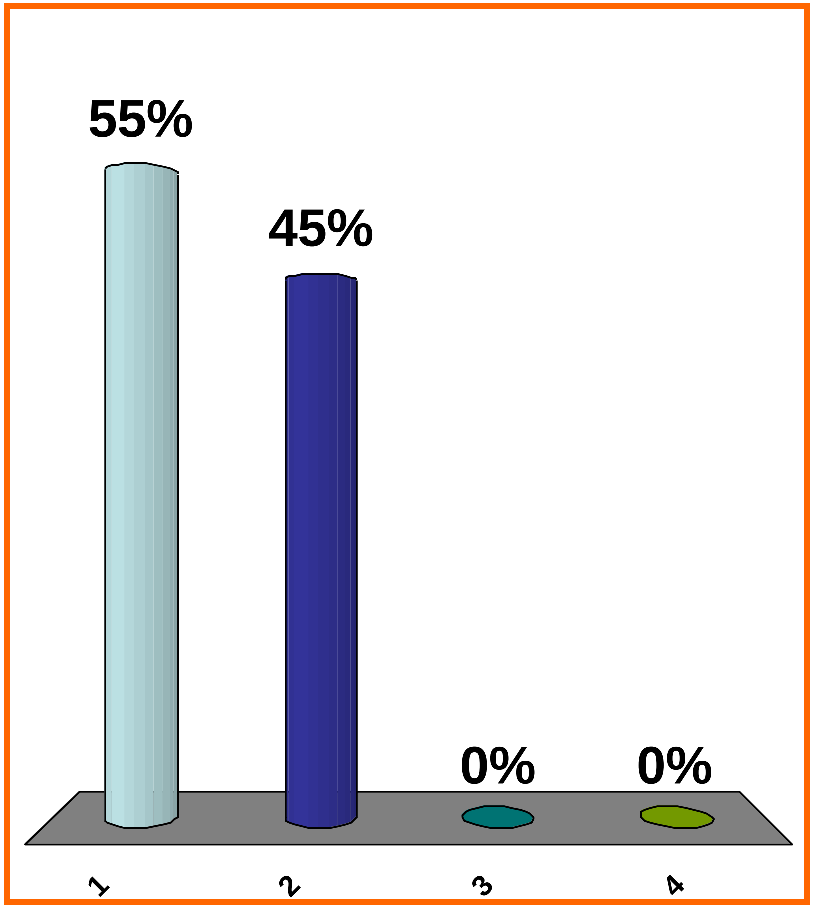
$$e^{\pi i/3} = ??$$

(a) $\boxed{\ }$ $\frac{1}{2} + \frac{\sqrt{3}}{2}i$

(b) $\frac{\sqrt{3}}{2} + \frac{1}{2}i$

(c) $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$

(d) none of the above



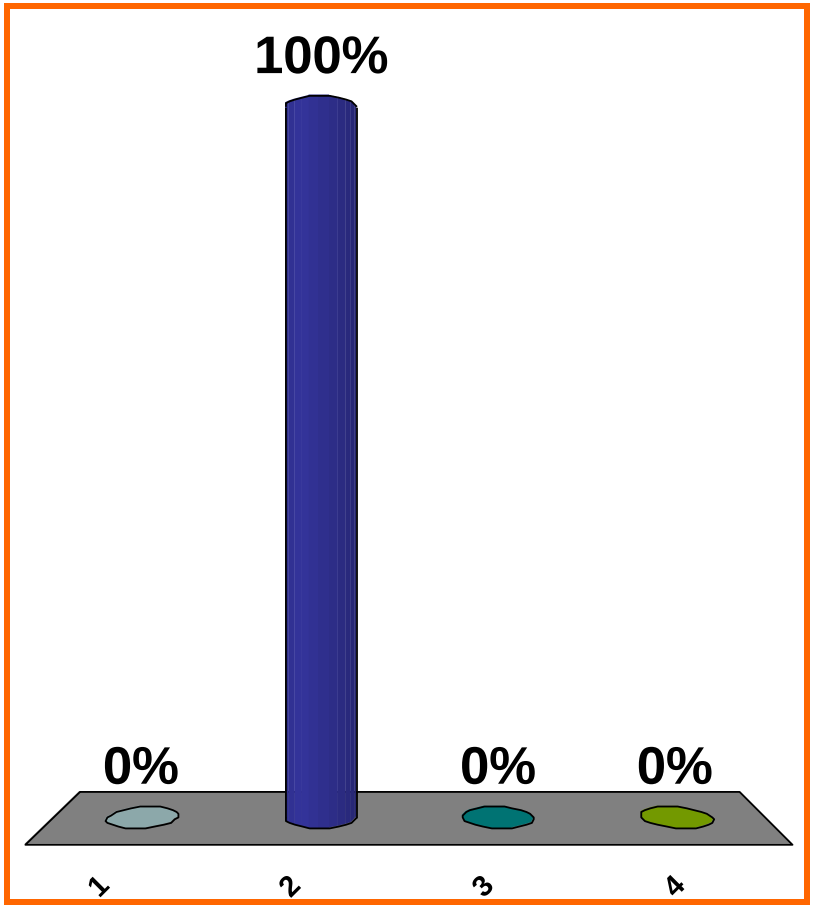
$$e^{\pi i/6} = ??$$

(a) $\frac{1}{2} + \frac{\sqrt{3}}{2} i$

(b) $\frac{\sqrt{3}}{2} + \frac{1}{2} i$

(c) $\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} i$

(d) none of the above



(a) $\frac{1}{2}+\frac{\sqrt{3}}{2}i$

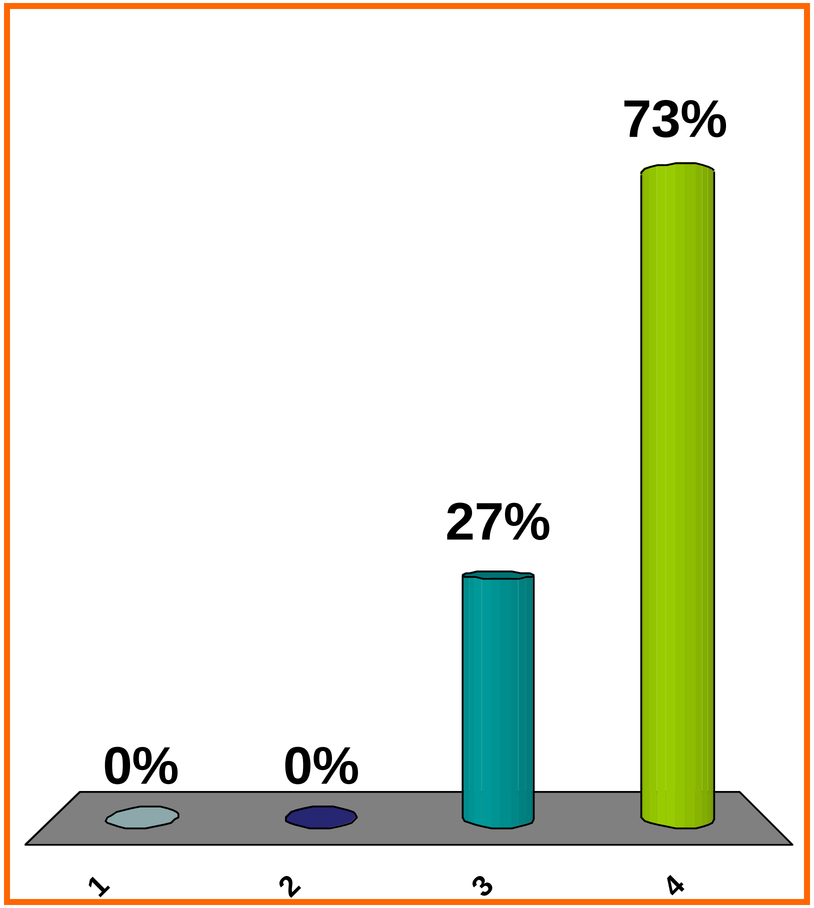
$$e^{-\pi i/4} = ??$$

(b) $\frac{\sqrt{3}}{2}+\frac{1}{2}i$

(c) $\frac{\sqrt{2}}{2}+\frac{\sqrt{2}}{2}i$

(d) none of the above

$$\frac{\sqrt{2}}{2}-\frac{\sqrt{2}}{2}i$$



(a) $U = 4e^x,\ V = 0$

$$z = x + iy$$

$$U + iV = 4e^z$$

$$U = ??,\ V = ??$$

(b) $U = 2e^x,\ V = 2e^y$

(c) $U = 4\cos x,\ V = 4\sin y$

$\boxed{\text{(d)}}$ none of the above

$$U = 4e^x \cos y,\ V = 4e^x \sin y$$

(a) $U = e^{4y}\cos(4x)$, $V = e^{4y}\sin(4x)$

(b) $U = e^{4x}\cos(4y)$, $V = e^{4x}\sin(4y)$

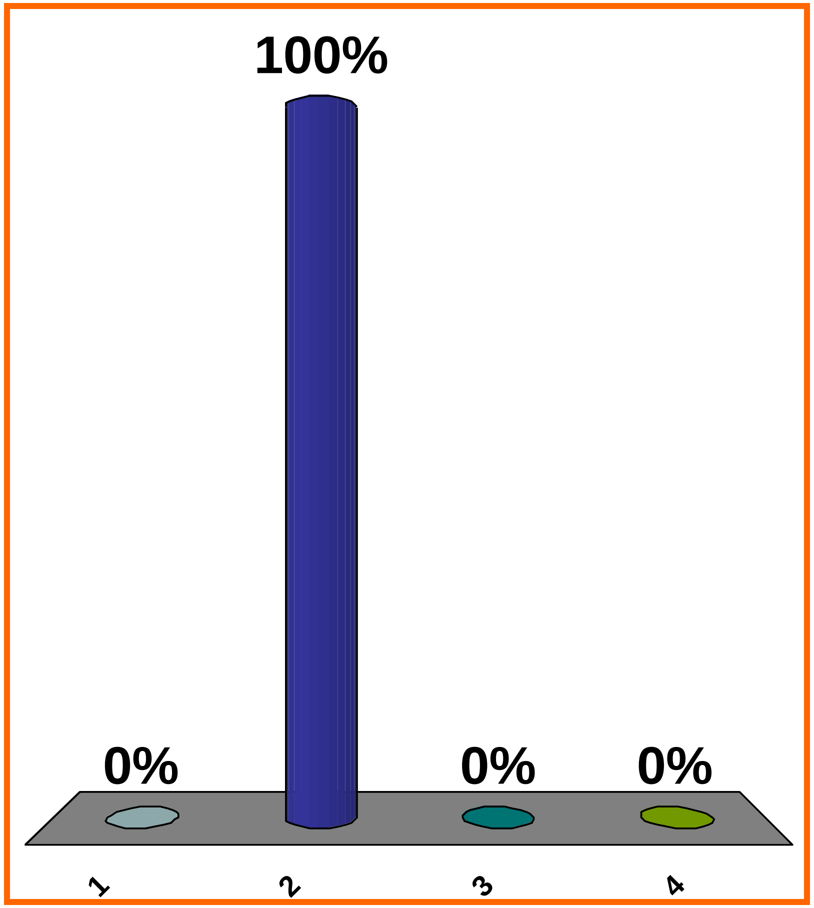
(c) $U = [e^{y}\cos(x)]^4$, $V = [e^{y}\sin(x)]^4$

(d) none of the above

$$z = x + iy$$

$$U + iV = e^{4z}$$

$$U = ??,\ V = ??$$



$$z = x + iy$$

$$U + iV = e^{4z-7}$$

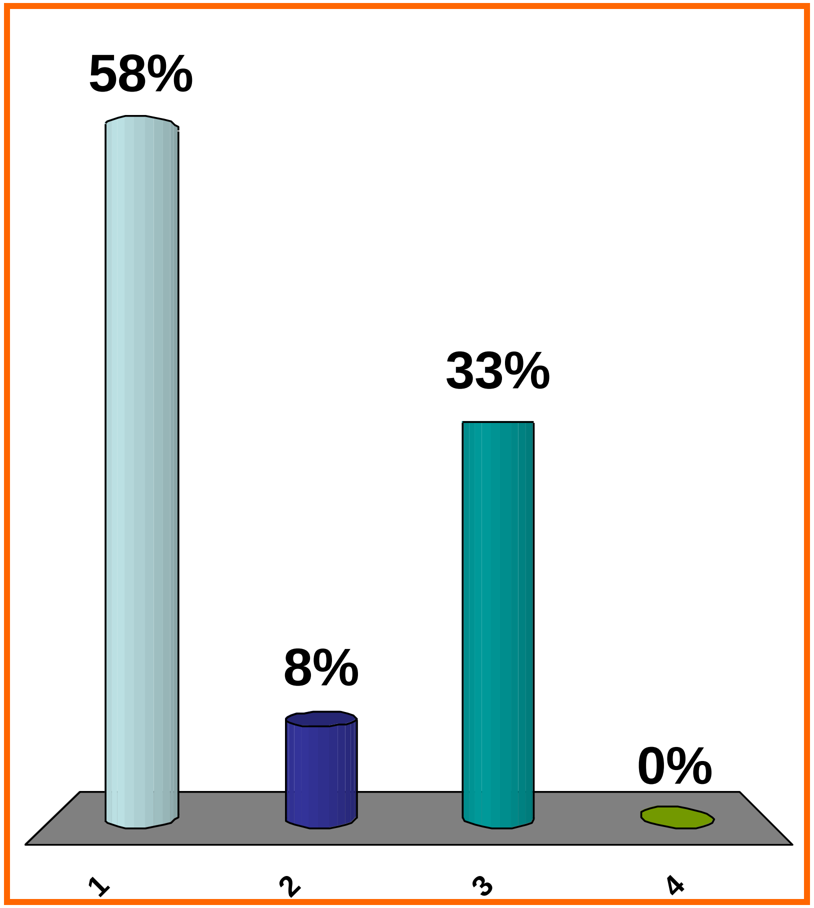
$$U = ??,\ V = ??$$

(a) $U = e^{4x-7}\cos(4y),$
$V = e^{4x-7}\sin(4y)$

(b) $U = e^{4x-7}\sin(4y),$
$V = e^{4x-7}\cos(4y)$

(c) $U = e^{4x-7}\cos(4y),$
$V = e^{4x}\sin(4y)$

(d) none of the above



$$L_M(x,y) = (3x - 4y, 2x + y, x)$$

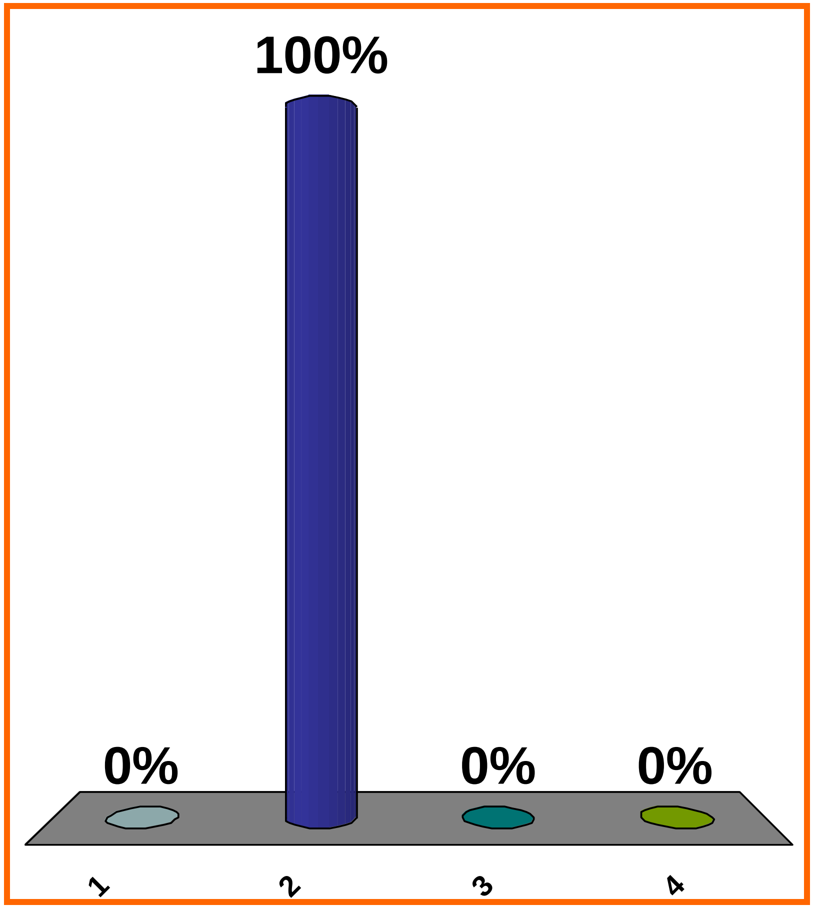
Dimensions of M?

(a) 2×3

(b) 3×2

(c) 3×3

(d) none of the above



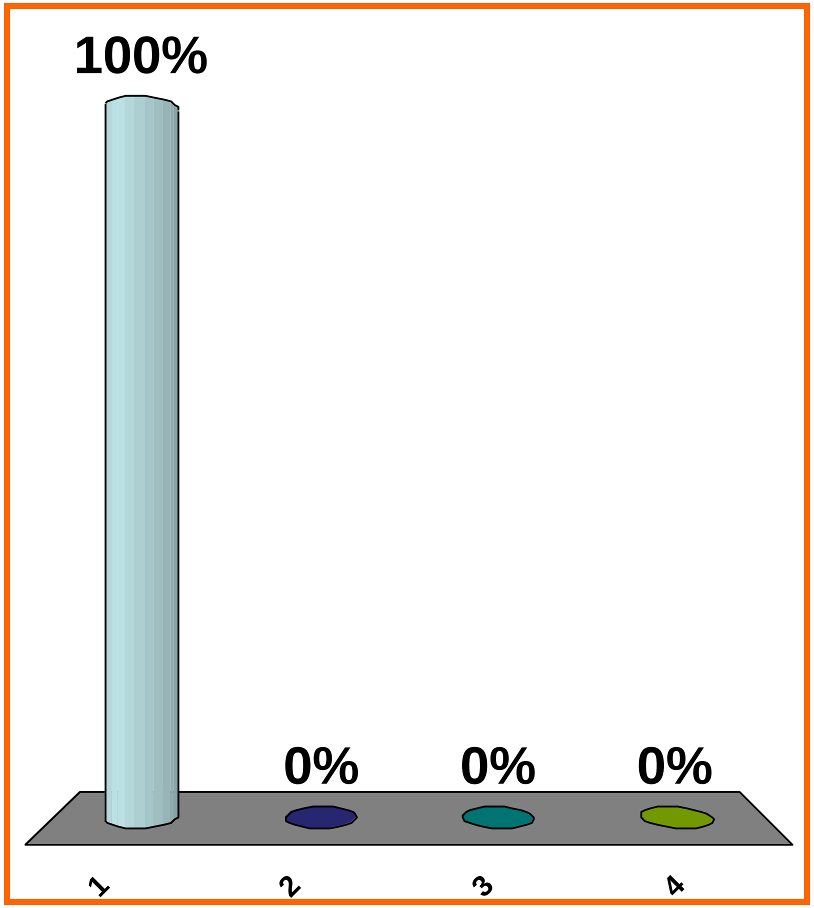
$$L_M(x,y) = (3x - 4y, 2x + y, x)$$
$$M = ??$$

(a) $\begin{bmatrix} 3 & -4 \\ 2 & 1 \\ 1 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 3 & 2 & 1 \\ -4 & 1 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & 2 & 1 \\ -4 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

(d) none of the above



$$L_M(x,y,z) = (3x - 4y + z, 2x + y - z)$$

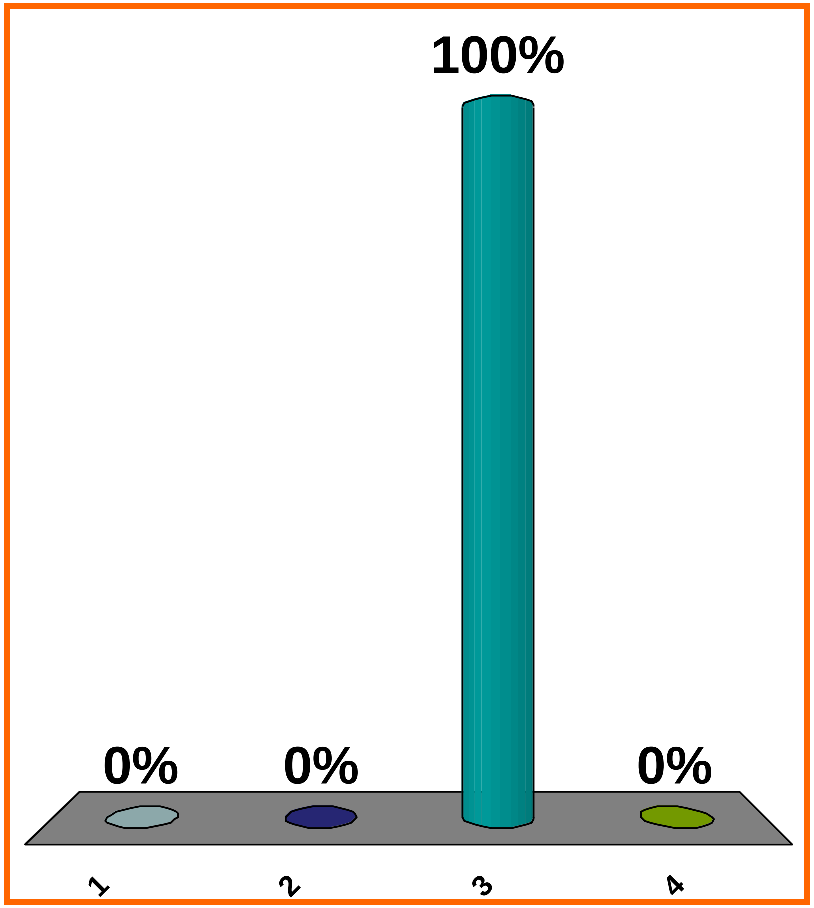
Dimensions of M?

(a) 2×3

(b) 3×2

(c) 3×3

(d) none of the above



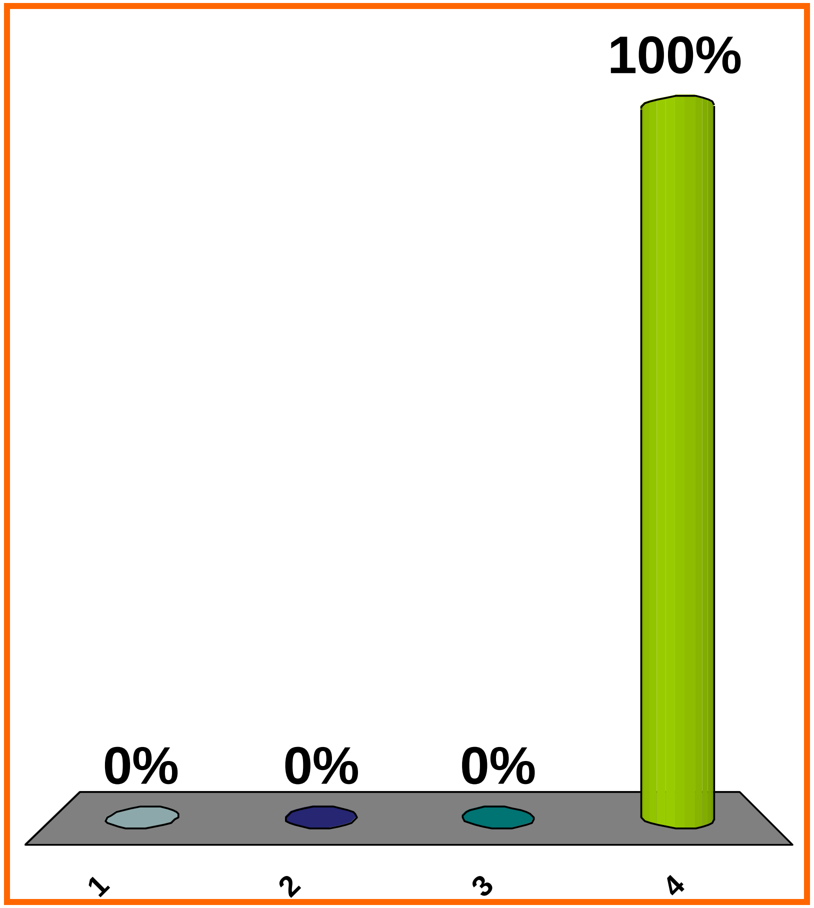
$$L_M(x,y,z) = (3x - 4y + z, 2x + y - z)$$
$$M = ??$$

(a) $\begin{bmatrix} 3 & 2 \\ -4 & 1 \\ 1 & -1 \end{bmatrix}$

(b) $\begin{bmatrix} 5 & -3 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & -4 & 1 \\ 2 & 1 & -1 \end{bmatrix}$

(d) none of the above



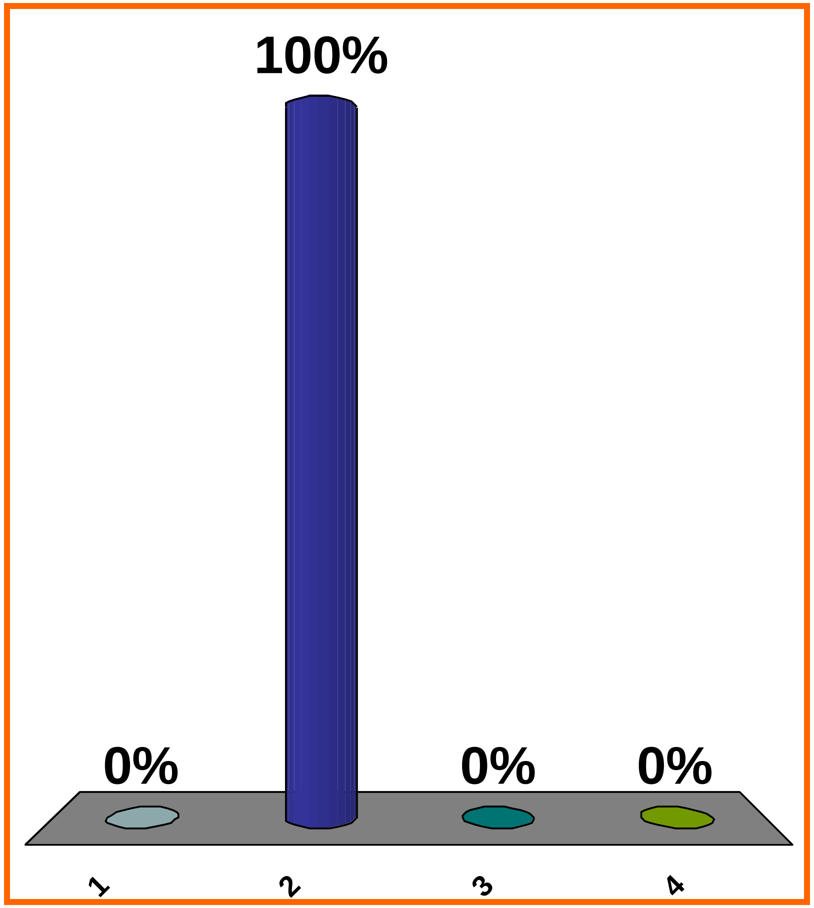
$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

(a) $\begin{bmatrix} 5+14 & 6+16 \\ 15+28 & 18+32 \end{bmatrix}$

(b) $\begin{bmatrix} 1\cdot 5 & 2\cdot 6 \\ 3\cdot 7 & 4\cdot 8 \end{bmatrix}$

(c) $\begin{bmatrix} 1+5 & 2+6 \\ 3+7 & 4+8 \end{bmatrix}$

(d) none of the above



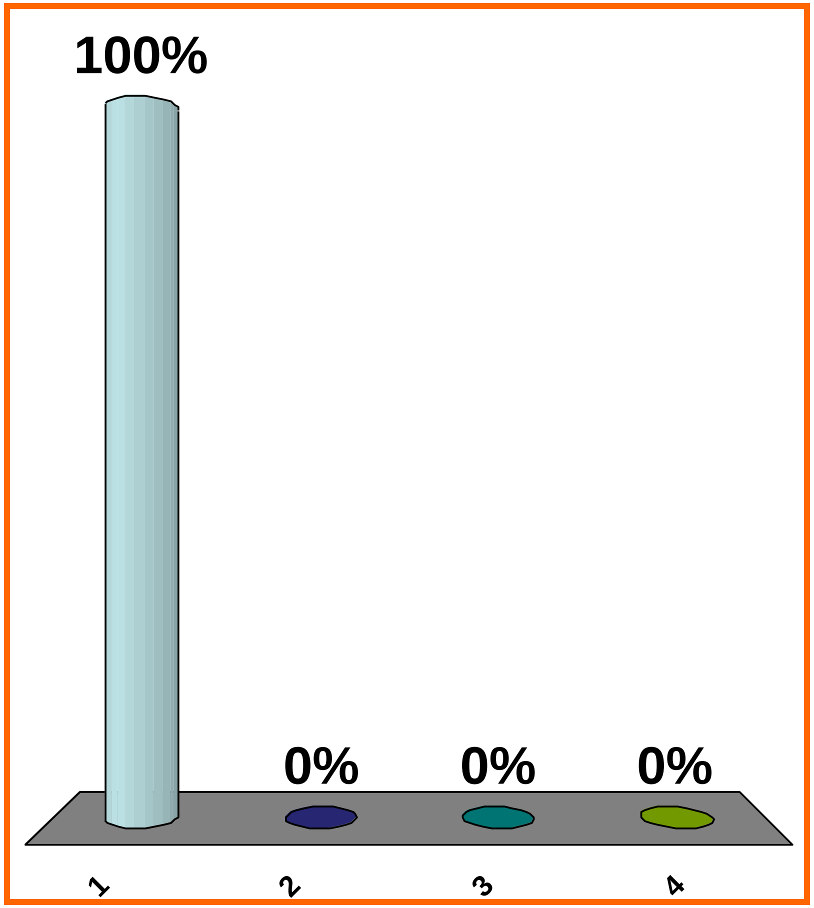
$$\begin{bmatrix} 2 & 0 \\ 0 & 5 \end{bmatrix} \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

(a) $\begin{bmatrix} 10 & 0 \\ 0 & 40 \end{bmatrix}$

(b) $\boxed{\begin{bmatrix} 10 & 12 \\ 35 & 40 \end{bmatrix}}$

(c) $\begin{bmatrix} 7 & 6 \\ 7 & 13 \end{bmatrix}$

(d) none of the above



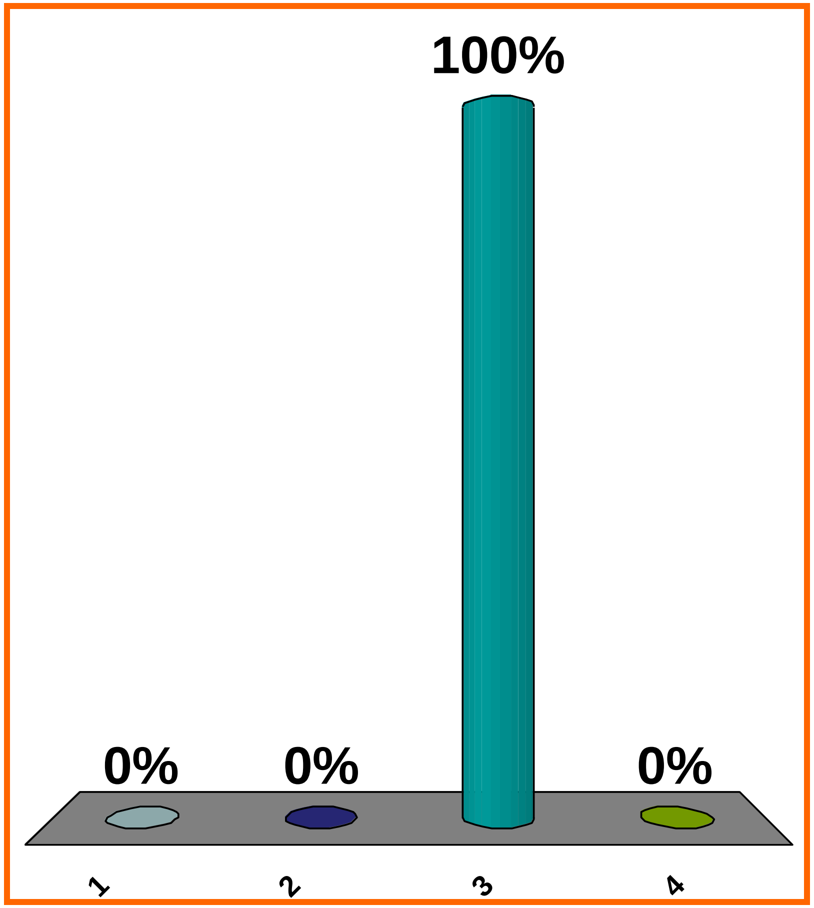
$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

(a) $\begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$

(b) $\boxed{\begin{bmatrix} 1 & 1+2 \\ 3 & 3+4 \end{bmatrix}}$

(c) $\begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} -1 & 0 \\ 2 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

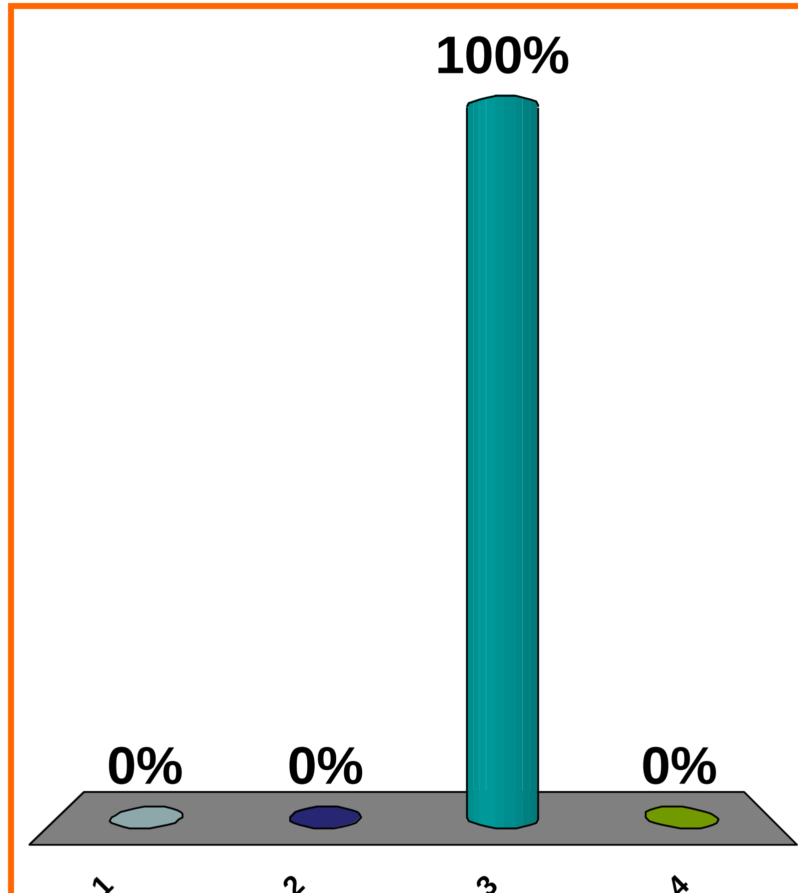
$$A \otimes B =$$

(a) $\begin{bmatrix} \begin{bmatrix} -2 & 0 \\ 4 & 0 \end{bmatrix} & \begin{bmatrix} -4 & 0 \\ 8 & 0 \end{bmatrix} \\ \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(b) $\begin{bmatrix} -2 & -4 \\ 4 & 8 \end{bmatrix}$

(c) $\begin{bmatrix} \begin{bmatrix} -2 & -4 \\ 1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 4 & 8 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

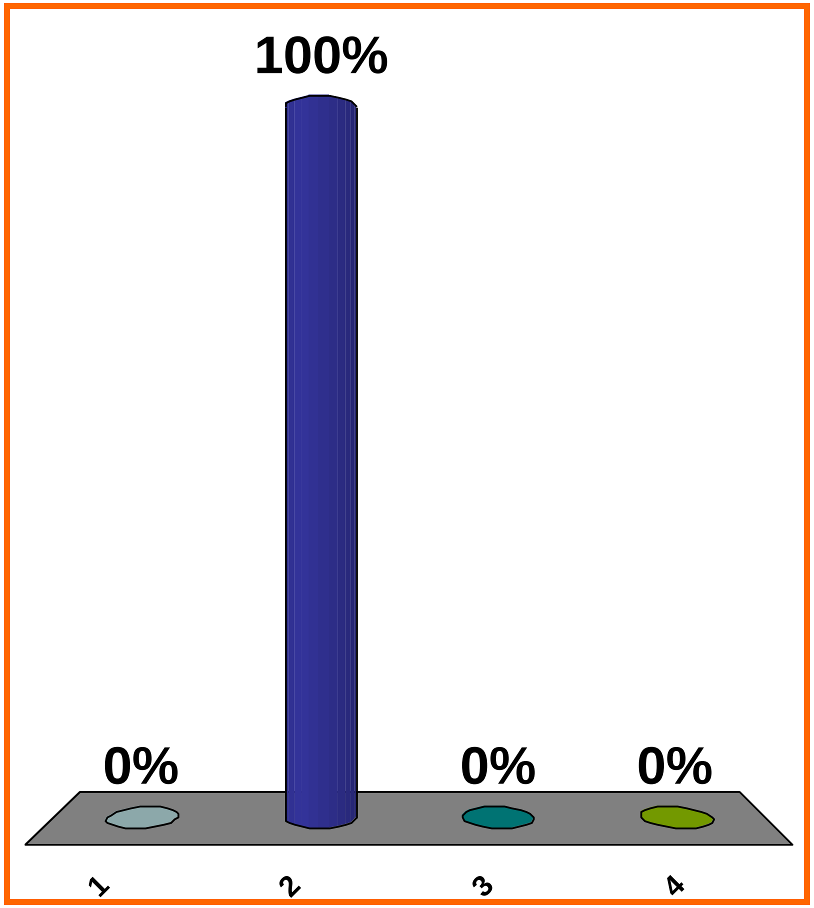
$$A \otimes B =$$

(a) $\begin{bmatrix} \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} & \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \end{bmatrix}$

(b) $\boxed{\begin{bmatrix} \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} & \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \\ \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}}$

(c) $\begin{bmatrix} \begin{bmatrix} -2 & -4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} -1 & 0 \\ 2 & 0 \end{bmatrix}$$

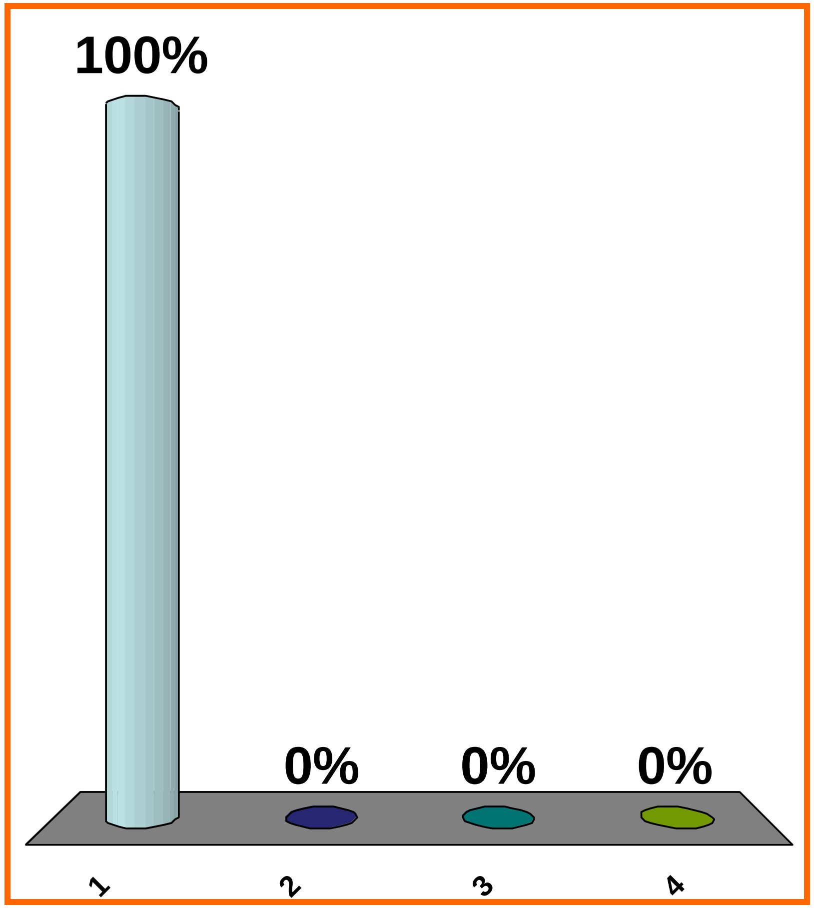
$$A \otimes B =$$

(a) $\begin{bmatrix} \begin{bmatrix} -2 & 0 \\ 4 & 0 \end{bmatrix} & \begin{bmatrix} -4 & 0 \\ 8 & 0 \end{bmatrix} \\ \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(b) $\begin{bmatrix} \begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix} & \begin{bmatrix} -4 & 0 \\ 8 & 0 \end{bmatrix} \\ \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(c) $\begin{bmatrix} \begin{bmatrix} -2 & -4 \\ 1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 4 & 8 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

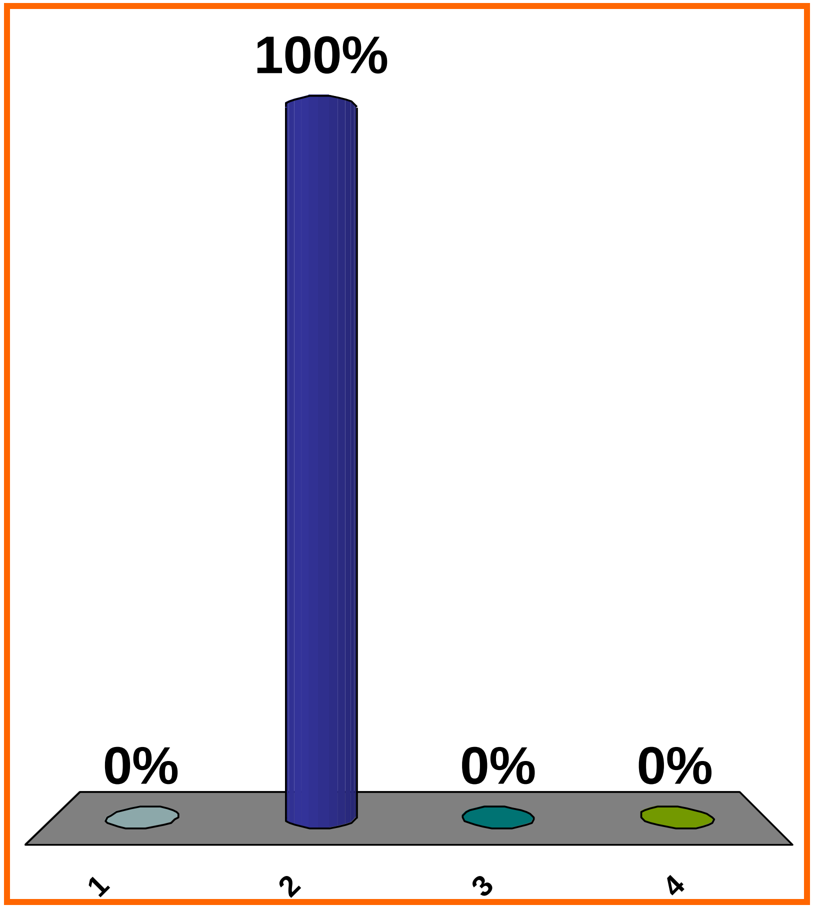
$$A \otimes B =$$

(a) $\begin{bmatrix} \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} & \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \end{bmatrix}$

(b) $\begin{bmatrix} \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} & \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \\ \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(c) $\begin{bmatrix} \begin{bmatrix} -2 & -4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} -1 & 0 \\ 2 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

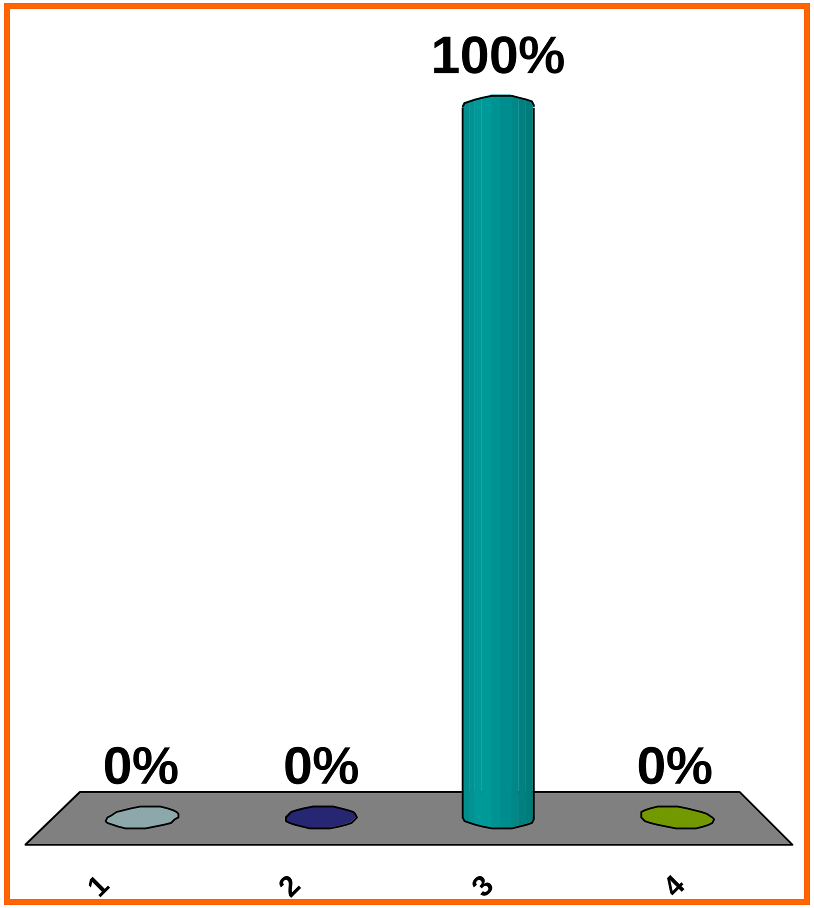
$$\mathcal{M}(A \otimes B) =$$

(a) $\begin{bmatrix} \begin{bmatrix} -2 & 0 \\ 4 & 0 \end{bmatrix} & \begin{bmatrix} -4 & 0 \\ 8 & 0 \end{bmatrix} \\ \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} & \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{bmatrix}$

(b) $\begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} -1 & 0 \\ 2 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} -1 & 0 \\ 2 & 0 \end{bmatrix} \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

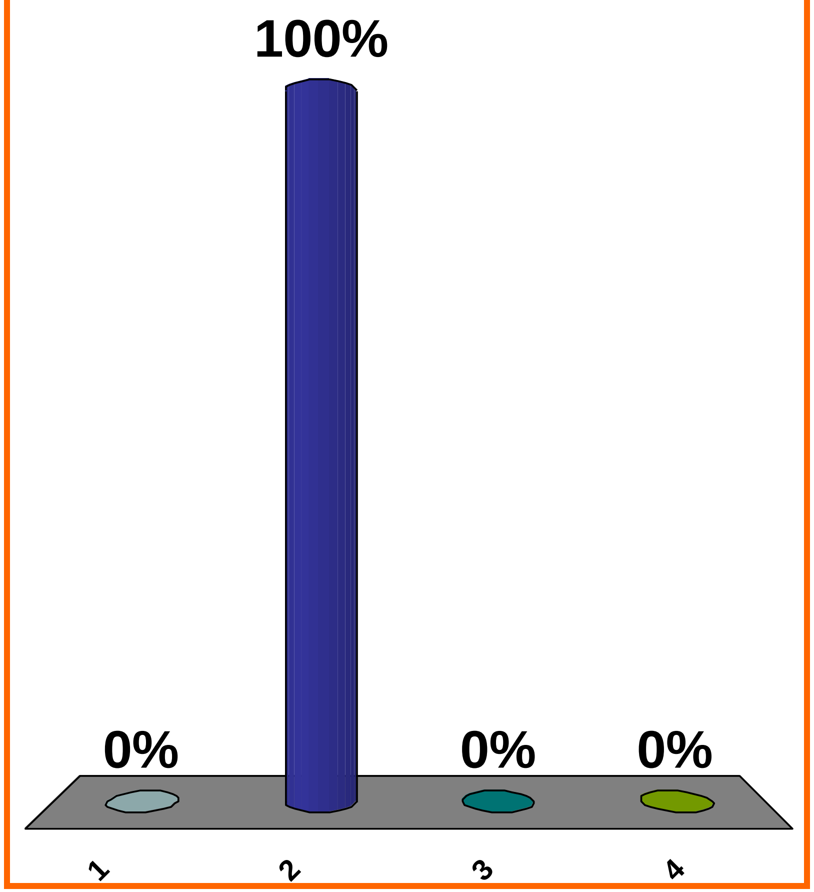
$$\mathcal{M}(A \otimes B) =$$

(a) $\begin{bmatrix} 4 & 2 \\ 0 & -1 \end{bmatrix}$

(b) $\begin{bmatrix} -1 & 0 \\ 2 & 4 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 4 \\ -1 & 0 \end{bmatrix}$$

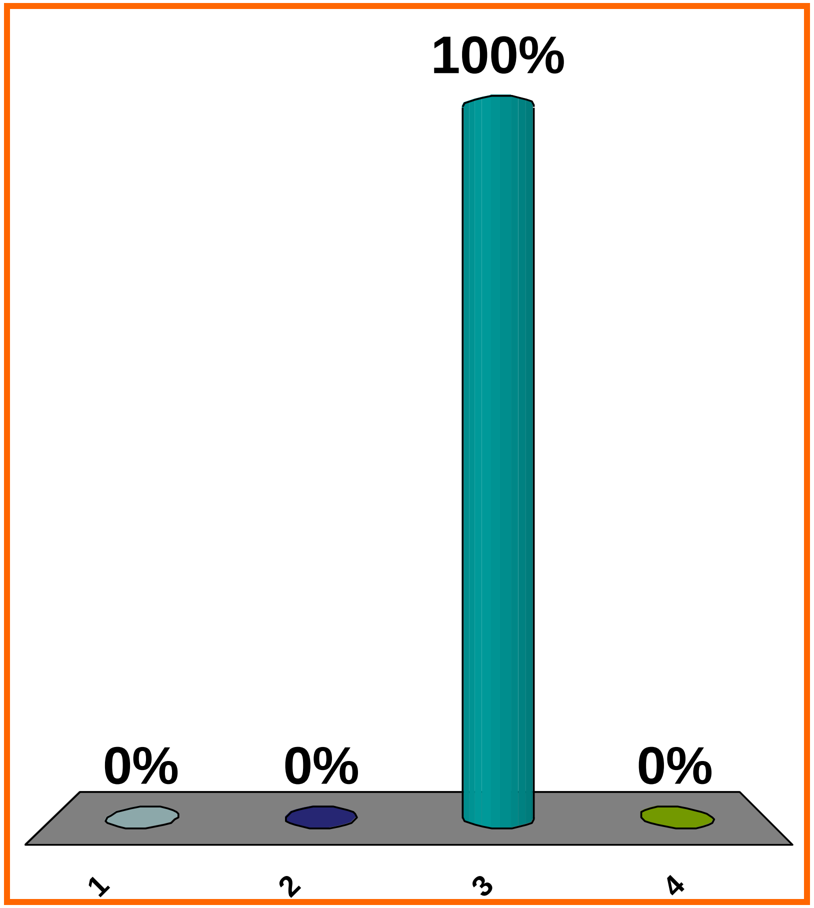
$$A \oplus B =$$

(a) $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 2 & 4 & 0 & 0 \\ -1 & 0 & 0 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 3 & 4 \\ -1 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 4 \\ 0 & 0 & -1 & 0 \end{bmatrix}$

(d) none of the above



$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \qquad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

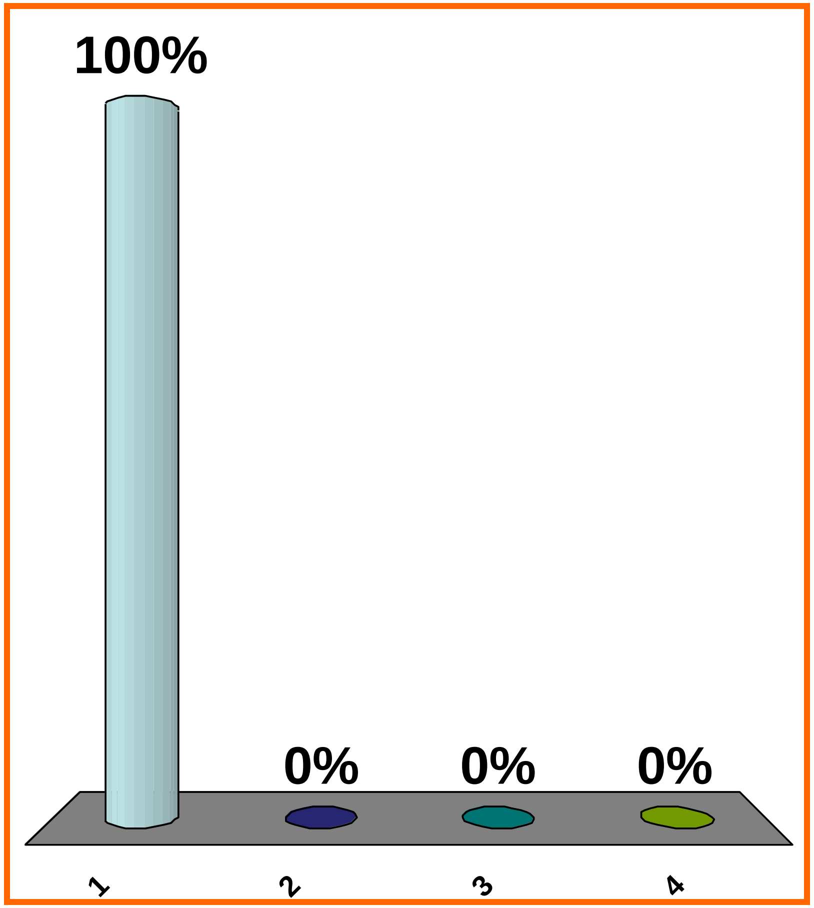
$$A \oplus B =$$

(a) $\begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \\ 0 & 0 & 5 & 6 \\ 0 & 0 & 7 & 8 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 2 & 1 & 2 \\ 3 & 4 & 3 & 4 \\ 5 & 6 & 5 & 6 \\ 7 & 8 & 7 & 8 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 6 & 0 & 0 \\ 7 & 8 & 0 & 0 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 3 & 4 \end{bmatrix}$

(d) none of the above



$$M := \begin{array}{cc} \begin{matrix} 1 & 0 & 1 \end{matrix} & \\ \begin{bmatrix} 1 & 0 & 3 \\ -1 & 2 & 0 \end{bmatrix} & \begin{matrix} -1 \\ 2 \end{matrix} \end{array} \qquad \begin{array}{l} v := (1,0,1), \\ w := (-1,2) \end{array}$$

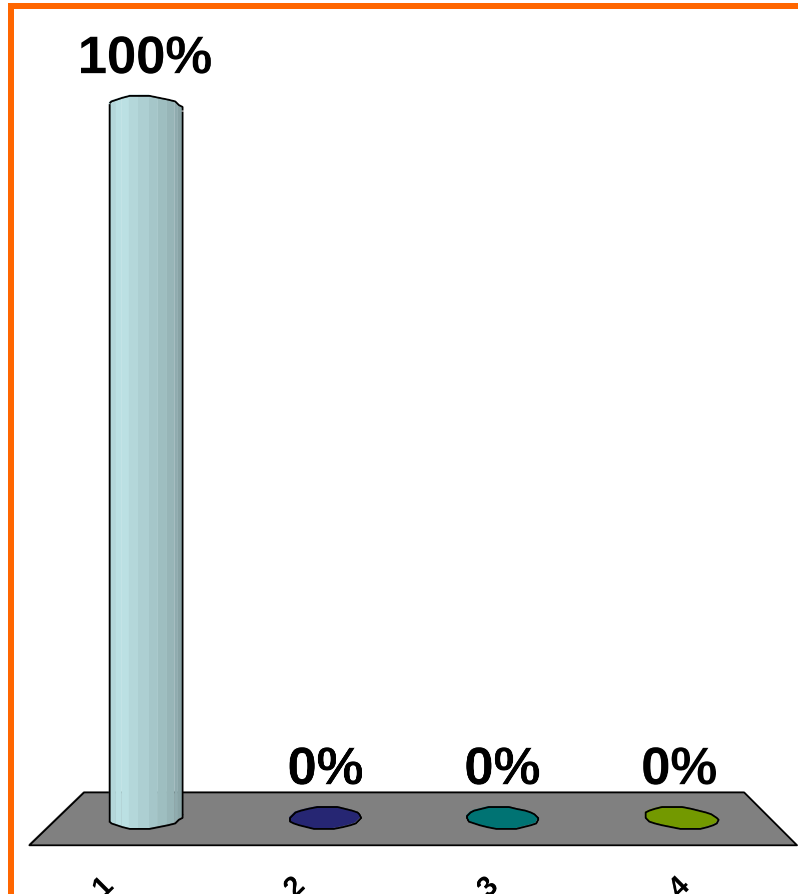
$$(L_M(v)) \cdot w = ??$$

(a) $2 + 6 + 1$

(b) 0

$\boxed{\text{(c) } -1 - 3 - 2}$

(d) none of the above



$$M := \begin{bmatrix} 1 & 0 & 3 \\ -1 & 2 & 0 \end{bmatrix}$$

$$v := (1,0,1),$$
$$w := (-1,2)$$

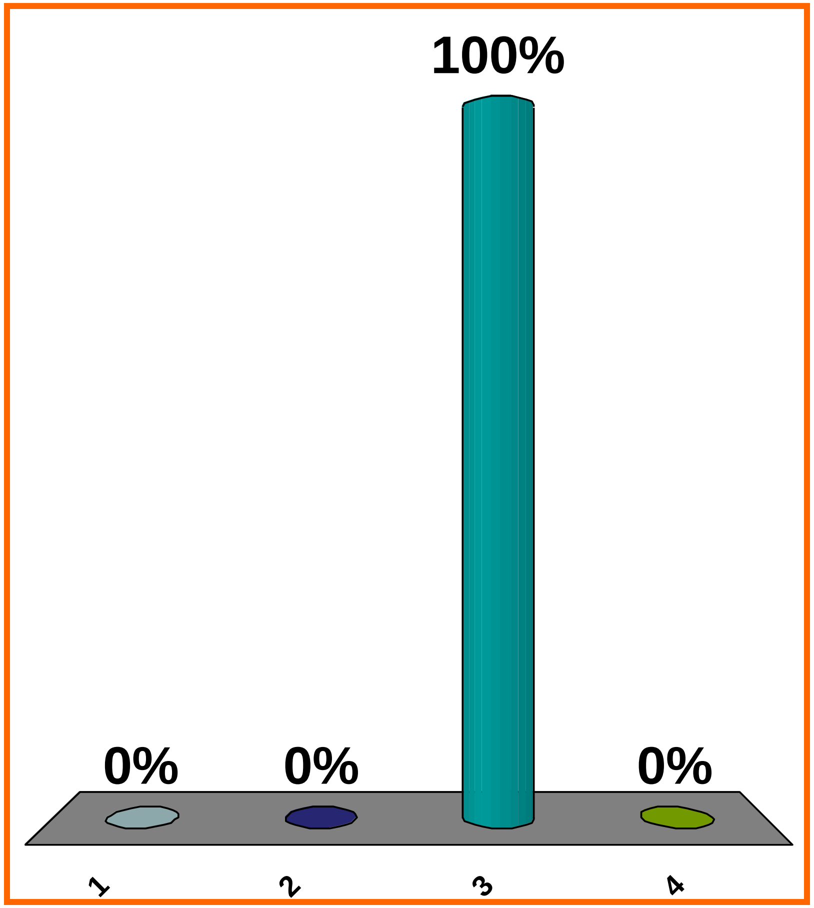
$$v \cdot (L_{M^t}(w)) = ??$$

(a) $2+6+1$

(b) 0

(c) $\boxed{-1-3-2}$

(d) none of the above



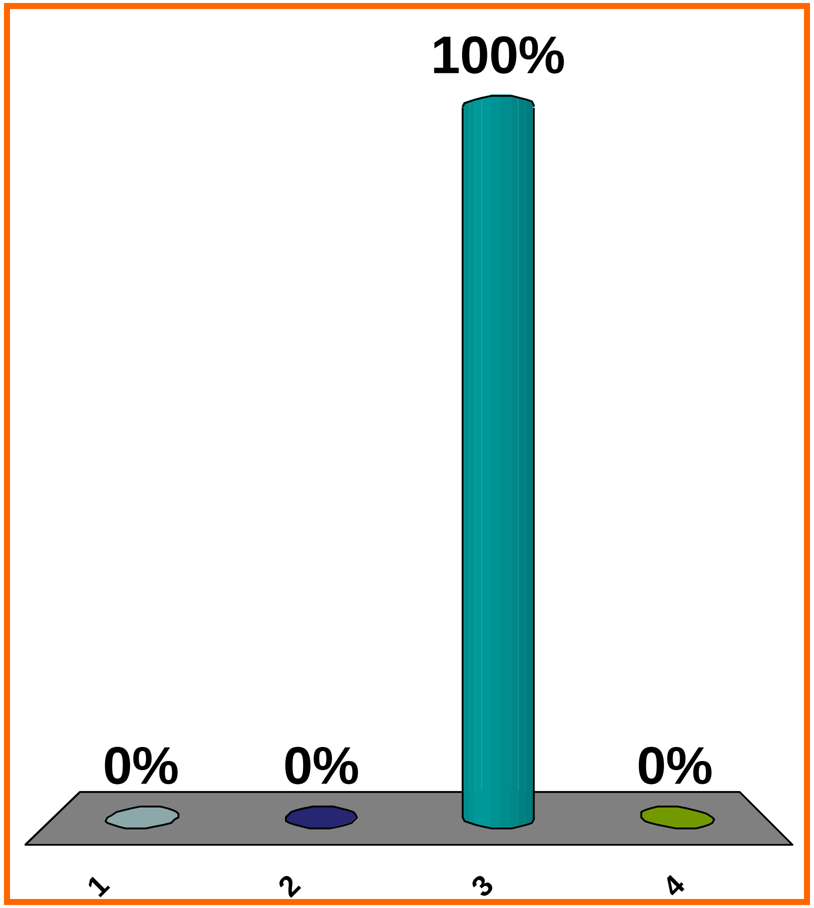
$$\exp \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & -4 \end{bmatrix}$$

(a) $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & -4 \end{bmatrix}$

(b) $\begin{bmatrix} e^2 & 1 & 1 \\ 1 & e^3 & 1 \\ 1 & 1 & e^{-4} \end{bmatrix}$

(c) $\boxed{\begin{bmatrix} e^2 & 0 & 0 \\ 0 & e^3 & 0 \\ 0 & 0 & e^{-4} \end{bmatrix}}$

(d) none of the above



$$\exp\begin{bmatrix} 6 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

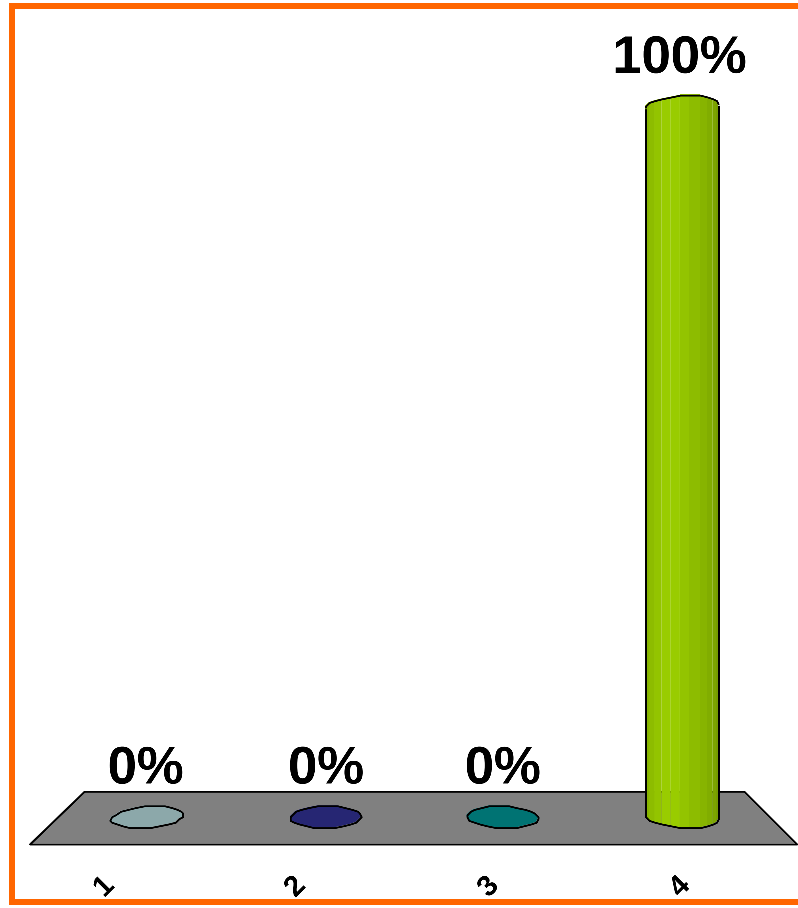
(a) $\begin{bmatrix} 6 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$

(b) $\begin{bmatrix} e^6 & 1 & 1 \\ 1 & e^{-1} & 1 \\ 1 & 1 & e^2 \end{bmatrix}$

(c) $\begin{bmatrix} 7 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

$$\begin{bmatrix} e^6 & 0 & 0 \\ 0 & e^{-1} & 0 \\ 0 & 0 & e^2 \end{bmatrix}$$

(d) none of the above



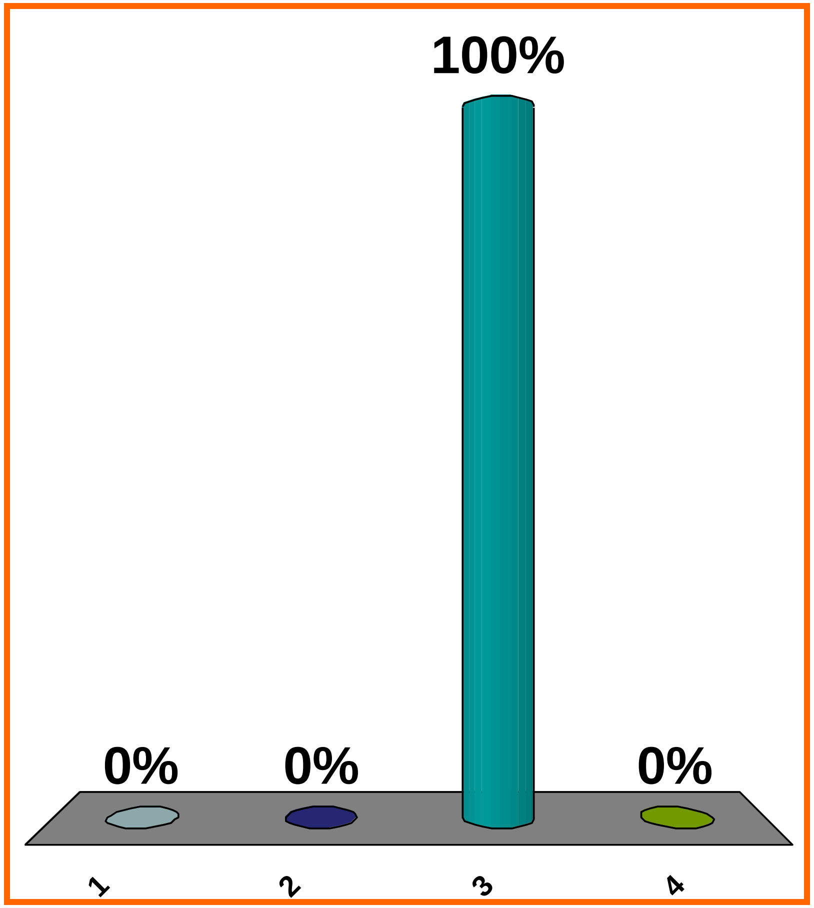
$$\exp\begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix}$$

(a) $\begin{bmatrix} e^{-1} & 1 & 1 \\ 1 & e^{-2} & 1 \\ 1 & 1 & e^{-3} \end{bmatrix}$

(b) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix}$

(c) $\begin{bmatrix} e^{-1} & 0 & 0 \\ 0 & e^{-2} & 0 \\ 0 & 0 & e^{-3} \end{bmatrix}$

(d) none of the above



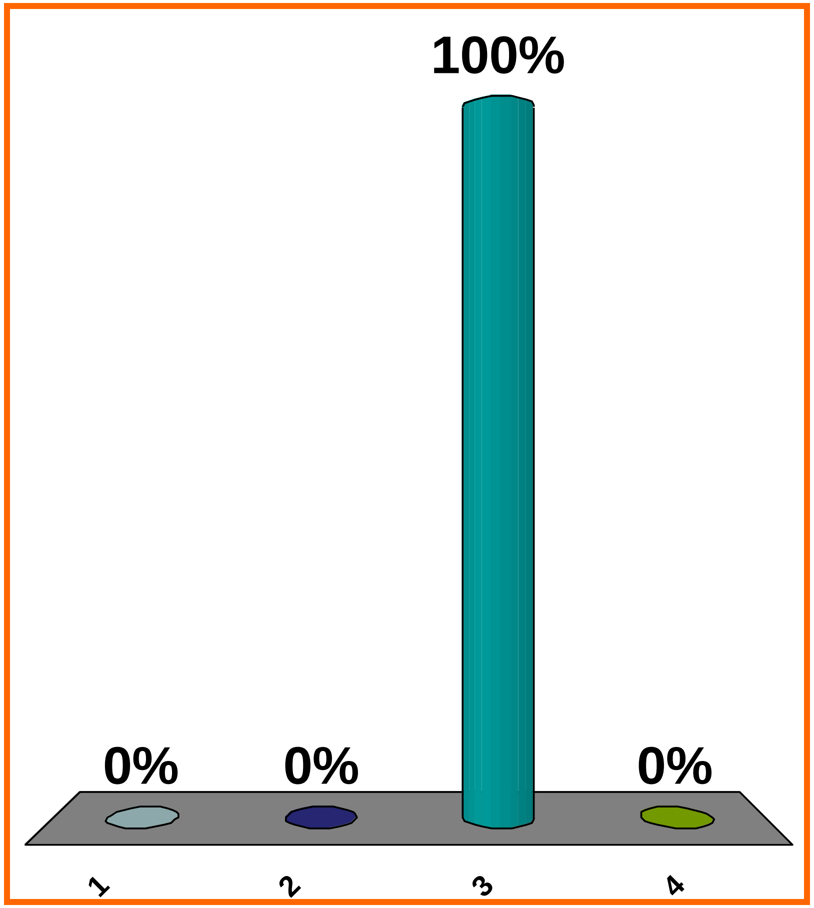
(a) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 1 & e \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

(c) $\boxed{\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}$

(d) none of the above

$$\exp \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$



$$\exp\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

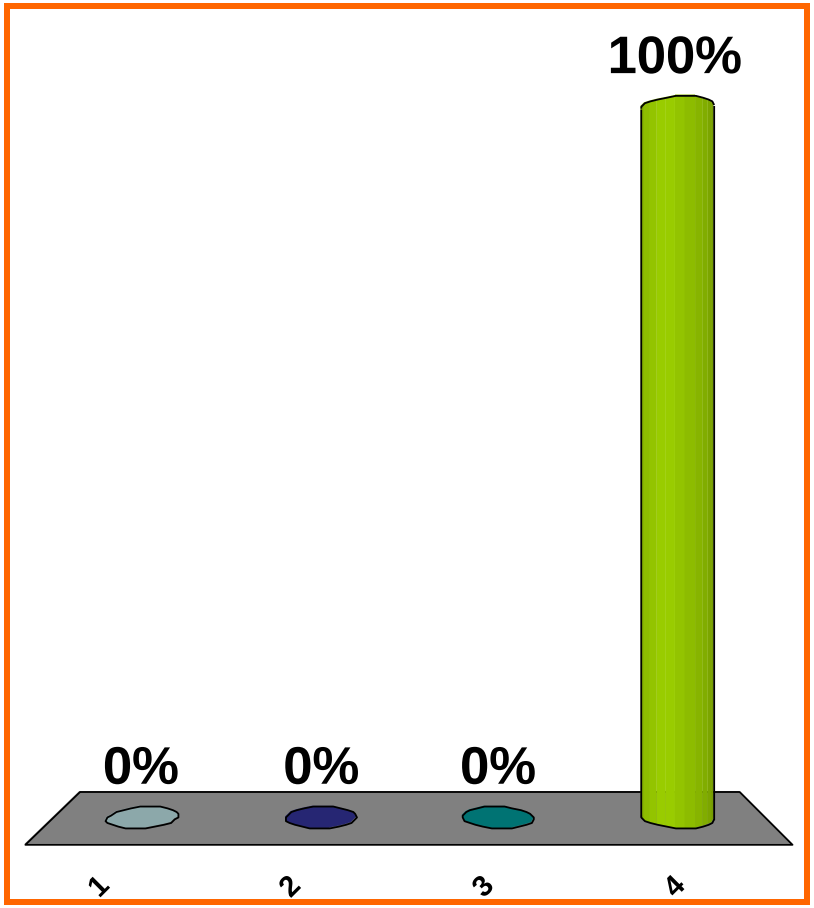
(a) $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & e & 1 \\ 1 & 1 & e \\ 1 & 1 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

$\begin{bmatrix} 1 & 1 & 1/2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

(d) none of the above



$$\exp \begin{bmatrix} 0 & 1 & 2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

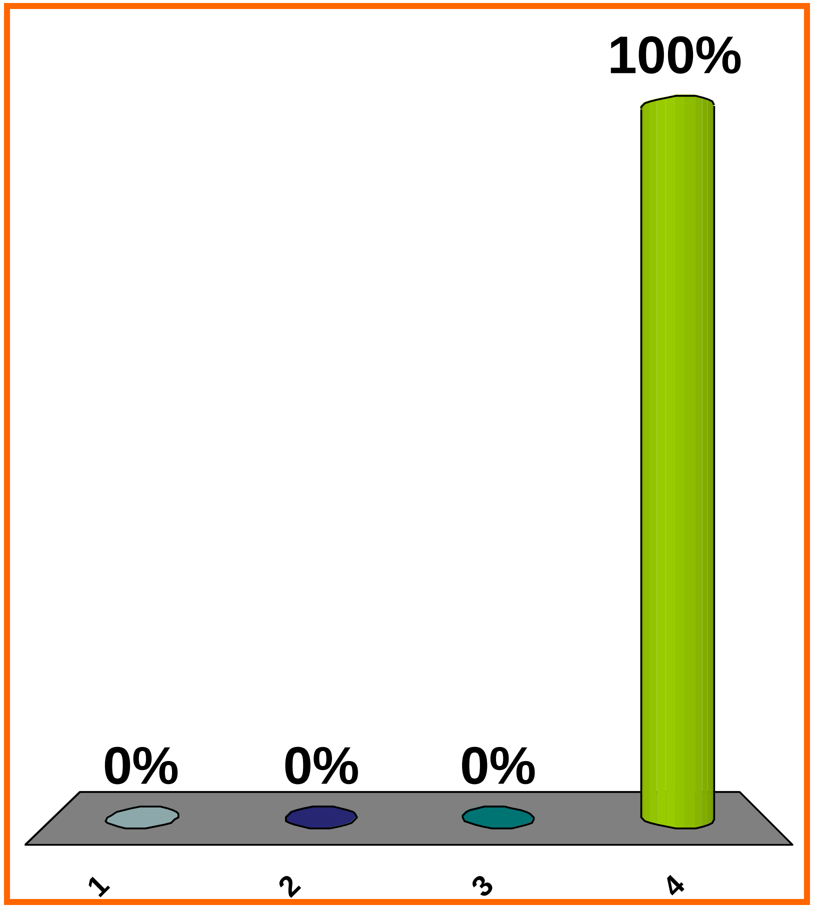
(a) $\begin{bmatrix} 0 & 1 & 2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & e & e^2 \\ 1 & 1 & e \\ 1 & 1 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 1 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

$$\begin{bmatrix} 1 & 1 & 5/2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

(d) none of the above



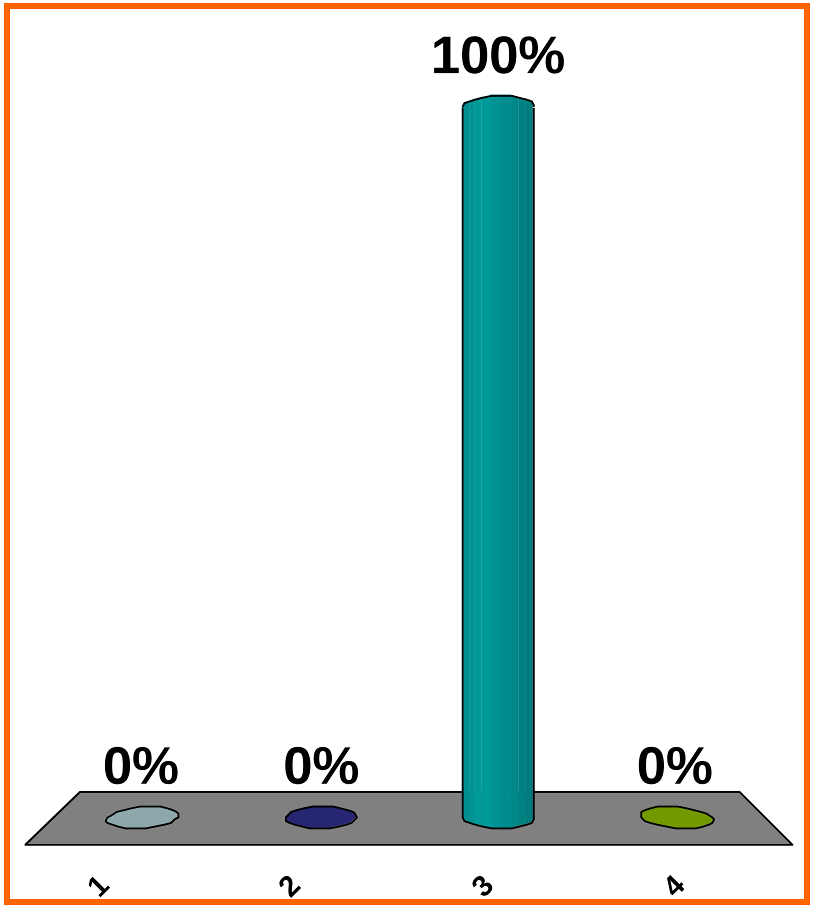
$$\exp\begin{bmatrix} 0 & 1 & -4 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

(a) $\begin{bmatrix} 0 & 1 & -4 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & e & e^{-4} \\ 1 & 1 & e \\ 1 & 1 & 1 \end{bmatrix}$

(c) $\boxed{\begin{bmatrix} 1 & 1 & -7/2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}}$

(d) none of the above



$$A := \begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$$

$$\exp A = ??$$

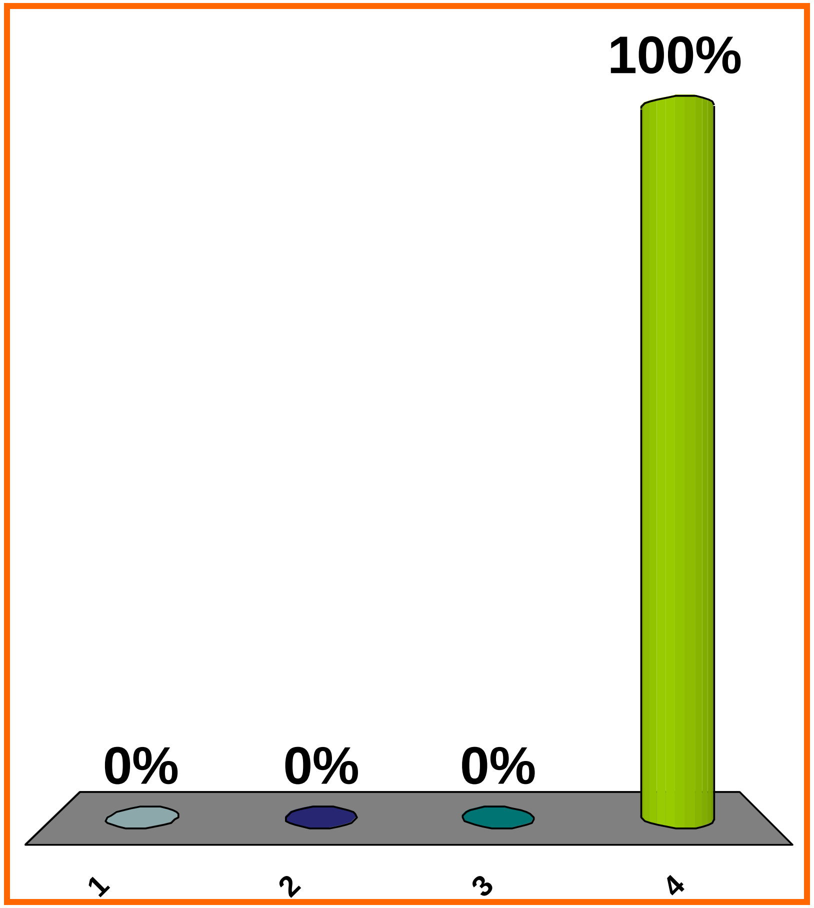
(a) $\begin{bmatrix} e^2 & e \\ 1 & e^2 \end{bmatrix}$

(b) $\begin{bmatrix} e^2 & e \\ 0 & e^2 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & 3/2 \\ 0 & 3 \end{bmatrix}$

$$\begin{bmatrix} e^2 & 0 \\ 0 & e^2 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

(d) none of the above



$$A := \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & -1 \end{bmatrix}$$

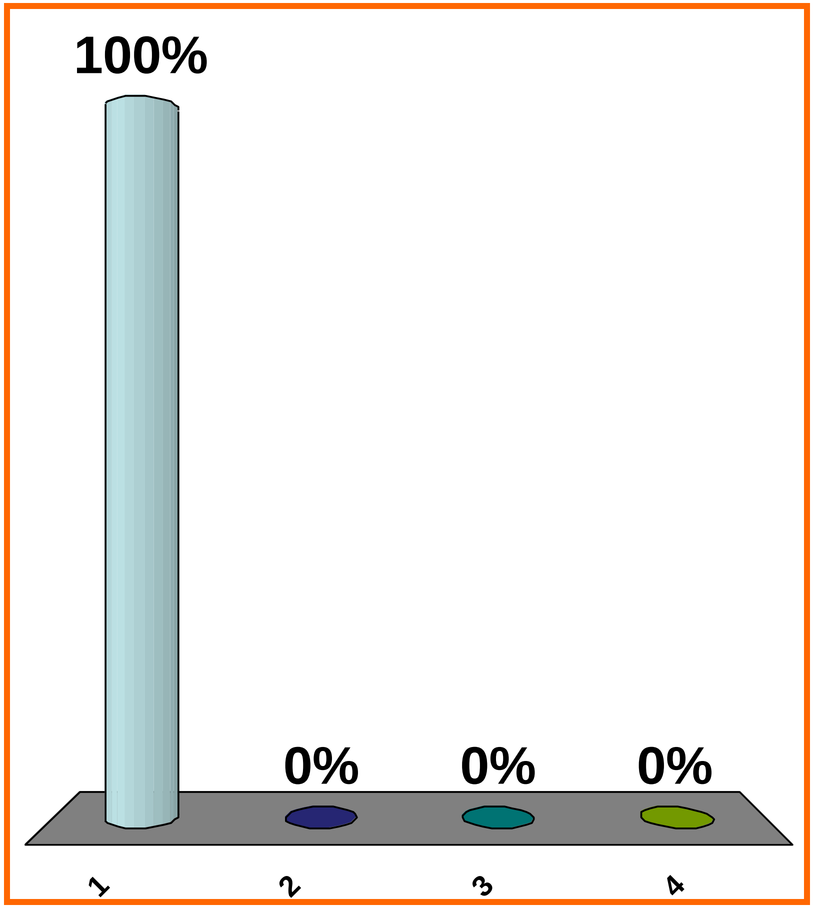
$$\exp A = ??$$

(a) $\begin{bmatrix} e^{-1} & 0 & 0 \\ 0 & e^{-1} & 0 \\ 0 & 0 & e^{-1} \end{bmatrix} \begin{bmatrix} 1 & 1 & 1/2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 1/2 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} e^{-1} & 1 & 1/2 \\ 0 & e^{-1} & 1 \\ 0 & 0 & e^{-1} \end{bmatrix}$

(d) none of the above



$$A := \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & -1 \end{bmatrix}, B := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

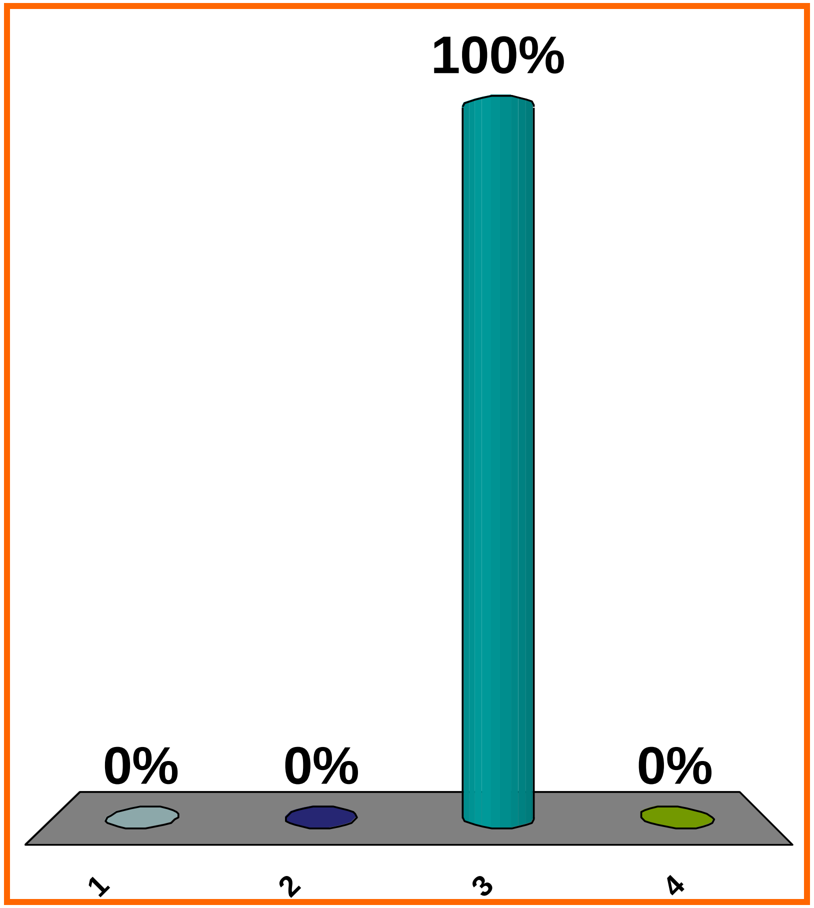
$$\exp(BAB^{-1}) = ??$$

(a) $[\exp(B)][\exp(A)][\exp(B^{-1})]$

(b) $[\exp(B)][\exp(A)][(\exp(B))^{-1}]$

(c) $[B][\exp(A)][B^{-1}]$

(d) none of the above



$$B := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

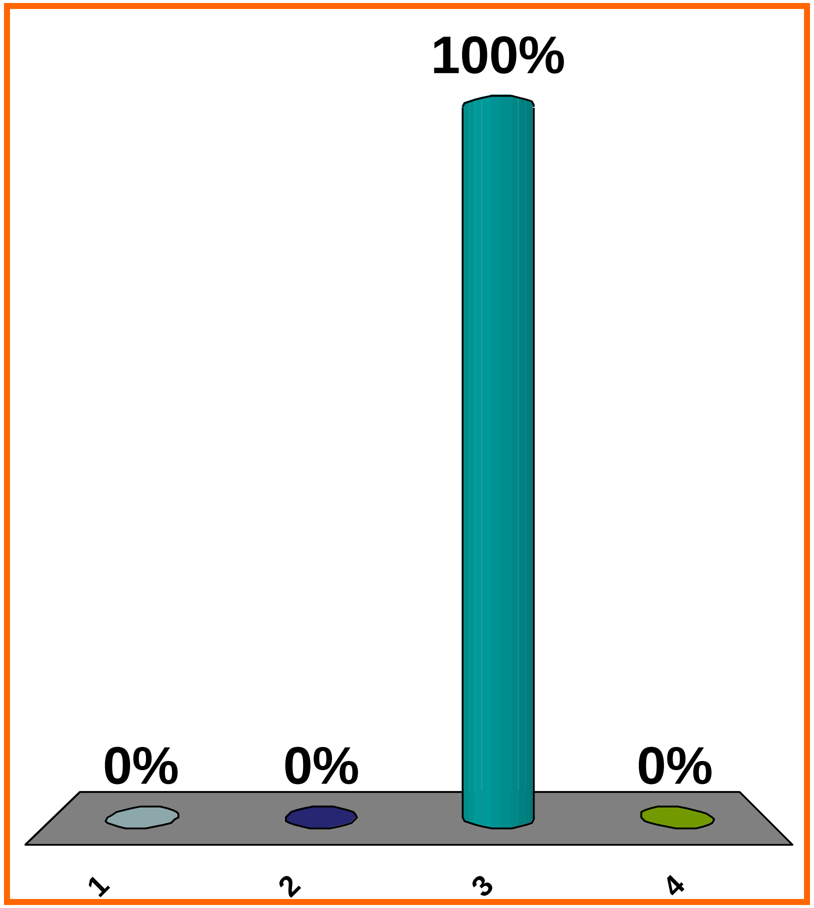
$$B^{-1} = ??$$

(a) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$

(c) $\boxed{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}}$

(d) none of the above



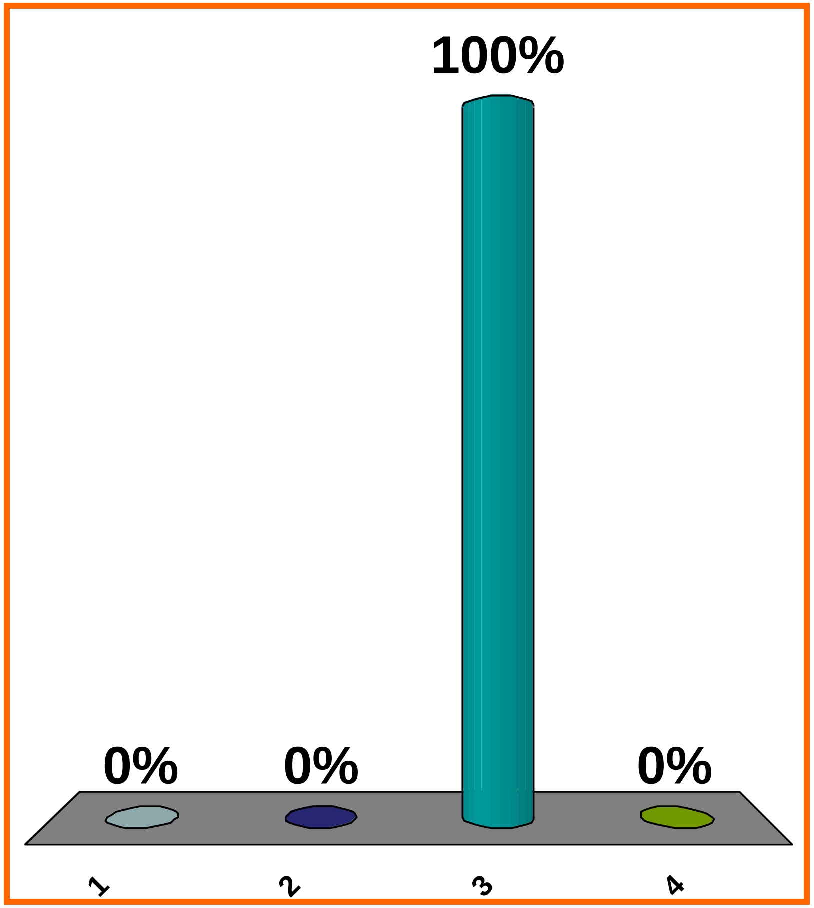
$$\exp(BAB^{-1}) = ??$$

(a) $[\exp(B)][\exp(A)][\exp(B^{-1})]$

(b) $[\exp(B)][\exp(A)][(\exp(B))^{-1}]$

(c) $\boxed{[B][\exp(A)][B^{-1}]}$

(d) none of the above



Financial Mathematics

Regular review session, Midterm 01

Discussion:

Meaning of injective? Surjective? Bijective?

Meaning of lower bound? Infimum?

Meaning of upper bound? Supremum?

min? max? liminf? limsup?

Def'n of $\sum a_j$.

What is a boundary point of a set?

What is an open set?
clopen?
What is a closed set?

What is a compact set? Cptly suppt'd fn?

How many ways of choosing
from a 10 element set,
7 element subsets?

How many ways of choosing
from a 10 element set,
3 element subsets?

Meaning of $|\bullet|$, $(\bullet)_+$, $(\bullet)_-$?

Discussion:

What is a linear combination? l.i.? l.d.?
What is a subspace?
What is the span of a subset?
What is a spanning set of a subspace?
What is a basis of a subspace?
What is a linear transformation?
What is a matrix?

$$\int e^{ax} e^{-x^2/2}\, dx$$

$$\int x^n e^{-x^2/2}\, dx$$

$$A := \begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 9 & -1 \end{bmatrix}$$

$$\begin{aligned} L_A(x, y, z) = (&2x + 3y + 4z, \\ &5x + 6y + 7z, \\ &8x + 9y - z) \\ =(&(2, 3, 4) \cdot (x, y, z), \\ &(5, 6, 7) \cdot (x, y, z), \\ &(8, 9, -1) \cdot (x, y, z)) \end{aligned}$$

$$\begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 9 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2x + 3y + 4z \\ 5x + 6y + 7z \\ 8x + 9y - z \end{bmatrix}$$

$$A := \begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 9 & -1 \end{bmatrix}$$

$$\begin{aligned} L_A(x,y,z) = (&2x + 3y + 4z, \\ &5x + 6y + 7z, \\ &8x + 9y - z) \\ = (&(2,3,4)\cdot(x,y,z), \\ &(5,6,7)\cdot(x,y,z), \\ &(8,9,-1)\cdot(x,y,z)) \end{aligned}$$

Is $L(x,y,z) = (2x + 4y, x^2 - 2y + z)$ linear?

The kernel and image of a linear function

Let V, W be subspaces of $\mathbb{R}^n$, $\mathbb{R}^k$, resp.
Let $L : V \to W$ be a linear function.

The kernel of L is

$$\boxed{\mathrm{ker}(L)} := \{v \in V \,|\, L(v) = 0\}.$$

Fact:
$L : V \to W$ is one-to-one iff $\mathrm{ker}(L) = \{0\}$.

The image of L is

$$\boxed{L(V)} := \{L(v) \in W \,|\, v \in V\}.$$

Observation:
$L : V \to W$ is onto iff $L(V) = W$.

Fact: Kernels and images are subspaces.

Ordered bases $\leftrightarrow$ isomorphisms w/ Eucl. space

Fact:

Let $(v_1, \ldots, v_d) \in V^d$ be an ordered basis of a subspace V of some Euclidean space.

Then the function $F : \mathbb{R}^d \to V$ defined by

$$F(a_1, \ldots, a_d) = a_1 v_1 + \cdots + a_d v_d$$

is a vector space isomorphism.

e.g.: Find an isomorphism from $\mathbb{R}^3$ to $\langle (1,3,5,7,9), (2,3,4,5,6), (5,1,1,1,1) \rangle$.

Review definitions:

injective, surjective, bijective
basis of a subspace
dimension of a subspace
linear transformation
image, kernel of a linear transformation
matrix of a linear transformation
left conjugate, right conjugate

Fact:

left inverse iff right inverse
iff injective iff surjective

Questions:

Can a nonsquare matrix be invertible?

Can every matrix be made diagonal through row operations?

Discussion:

What are

$$A + B,\ A \oplus B,\ AB,\ A \otimes B,\ e^A?$$

$$y = (f(x))^{g(x)} \qquad \frac{dy}{dx} = ??$$

$$\frac{dy}{dx} = [(f(x))^{g(x)}] \frac{d}{dx} \ln[(f(x))^{g(x)}]$$

$$= [(f(x))^{g(x)}] \frac{d}{dx}[g(x) \cdot \ln(f(x))]$$

$$= [(f(x))^{g(x)}][g'(x) \cdot \ln(f(x)) +$$

$$g(x) \cdot \frac{f'(x)}{f(x)}]$$

$$1 + (1/3) + (1/5) + (1/7) + \cdots = ??$$

$$1 + (1/100) + (1/200) + (1/300) + \cdots = ??$$

$$1 + (1/2) + (1/4) + (1/8) + \cdots = ??$$

$$1 + (1/3) + (1/9) + (1/27) + \cdots = ??$$

$$1 + (2/3) + (4/9) + (8/27) + \cdots = ??$$

$$1 + 2 + 4 + 8 + 16 + \cdots = ??$$

$$1 + 2 + 4 + 8 + 16 + \cdots + 2^{100} = ??$$

$$1 + (2/3) + (4/9) + (8/27) + \cdots + (2/3)^{75} = ??$$

$$1 + (2/3) + (3/9) + (4/27) + (5/81) + \cdots = ??$$

$$\lim_{n\to\infty}\left(1+\frac{x}{n}+\frac{\delta_n}{n}\right)$$

$$f(x)=1+cx^2+[\varepsilon(x)][x^2]$$
$$\lim_{n\to\infty}[(f(x/\sqrt{n})]^n$$

$$[\underline{-(x^2/2)} + 4x + 3]_{x:\to x+4}$$

$$= \quad -(x^2/2) + \cancel{4x} + 3 + (4^2/2)$$

2. Eliminate the linear term in

$$y = -(x^2/2) + 4x + 3$$

a. $-(x^2/2) + 3$

b. $\boxed{-(x^2/2) + 3 + (4^2/2)}$

c. $-(x^2/2) + 3 - (4^2/2)$

d. $x^2 + 4x + 3$

e. None of the above

1. $(1+2i)(-3-4i) =$

a. $-11-10i$

c. $8-6i$

b. $\boxed{5-10i}$

d. $-3-4i$

e. None of the above

$$\begin{aligned}(1+2i)(-3-4i) &= -3 \boxed{-8i^2} -6i - 4i \\ &= -3+8-6i-4i \\ &= 5-10i\end{aligned}$$


STOP

IRREGULARITIES: