Financial Mathematics

Clicker review session, Final

$$i := \sqrt{-1}$$

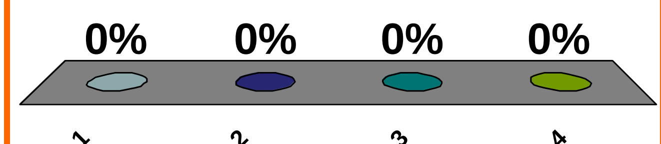
$$e^{4+3i} = ??$$

(a) $e^4[(\cos 3) + i(\sin 3)]$

(b) $e^4[(\sin 3) + i(\cos 3)]$

(c) $e^3[(\sin 4) + i(\cos 4)]$

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

$$i := \sqrt{-1}$$

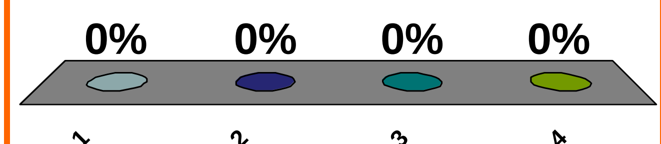
$$e^{(\ln 2)+(\pi/2)i} = ??$$

(a) 2

(b) -2

(c) $2i$

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

$$i := \sqrt{-1}$$

$$e^{-1+\pi i} = ??$$

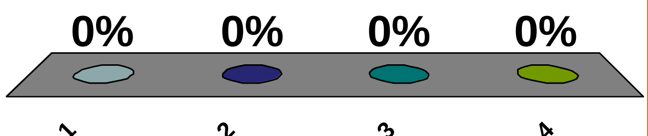
(a) i/e

(b) $-i/e$

(c) $1/e$

(d) none of the above

Correct answer: $-1/e$



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0 of 5

$$i := \sqrt{-1}$$

$$3 + 5i = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

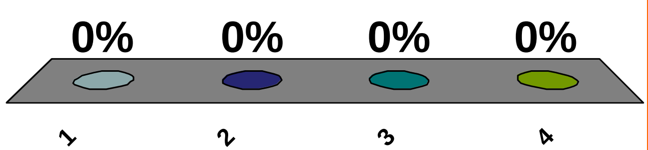
Find r.

(a) $r = 3^2 + 5^2$

(b) $r = \sqrt{3^2 + 5^2}$

(c) $r = 3 + 5$

(d) none of the above



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0 of 5

$$i := \sqrt{-1}$$

$$-3 = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

Find r.

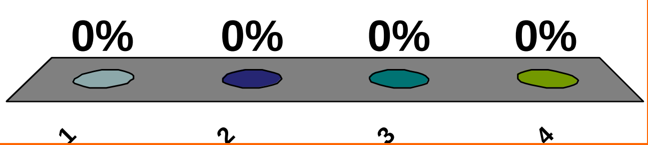
(a) -3

(b) 0

(c) $3i$

(d) none of the above

Correct answer: 3



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0 of 5

$$i := \sqrt{-1}$$

$$1 + i = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

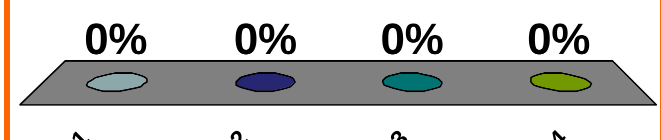
Find r.

(a) 1

(b) 2

$\boxed{\text{(c) } \sqrt{2}}$

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

$$i := \sqrt{-1}$$

$$3 + 5i = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

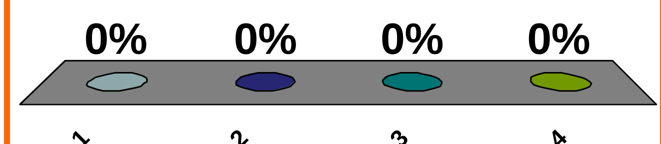
Find θ.

(a) tan(3/5)

(b) arctan(3/5)

(c) arctan(5/3)

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

$$i := \sqrt{-1}$$

$$-3 = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

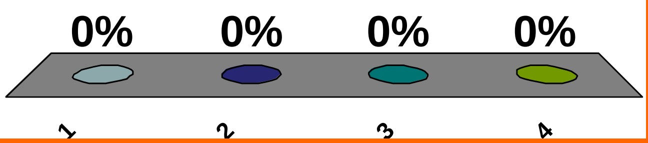
Find θ.

(a) 0

(b) $\pi/2$

(c) π

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

$$i := \sqrt{-1}$$

$$1 + i = re^{i\theta}$$

$$(r \geq 0,\ 0 \leq \theta < 2\pi)$$

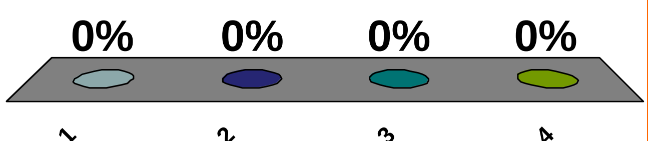
Find θ.

(a) $\pi/4$

(b) $\pi/2$

(c) π

(d) none of the above



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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

0 of 5

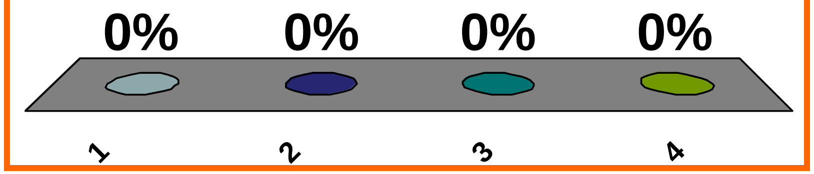
$$\dim \operatorname{im} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

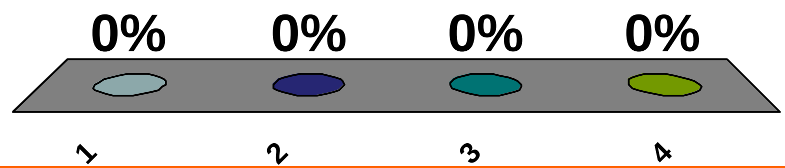
$$\dim \operatorname{im} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above 3



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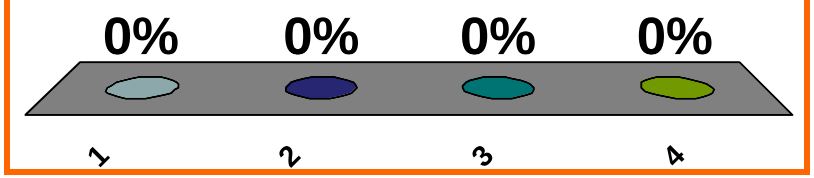
$$\dim \operatorname{im} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 1

(b) 2

(c) 3

(d) none of the above



0 of 5

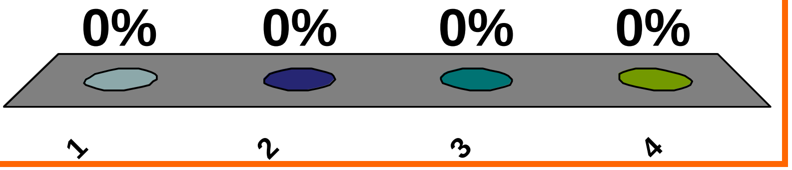
$$\dim \operatorname{im} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



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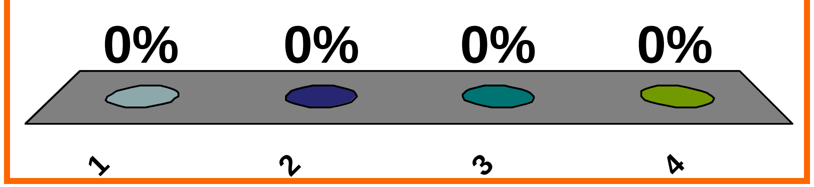
$$\dim \operatorname{im} \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

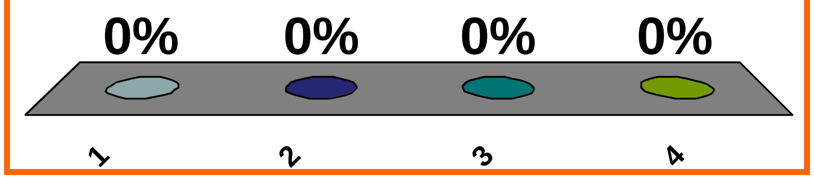
$$\dim \ker \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

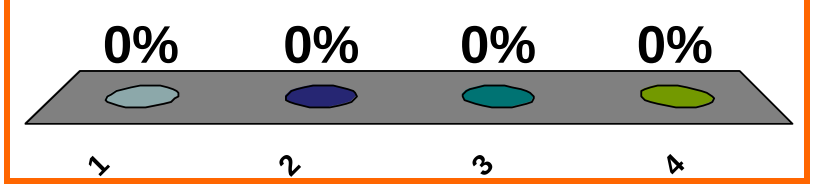
$$\dim \ker \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} =$$

(a) 0

(b) $\boxed{1}$

(c) 2

(d) none of the above



0 of 5

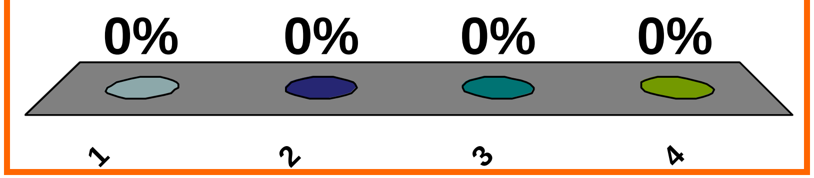
$$\dim\ker \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

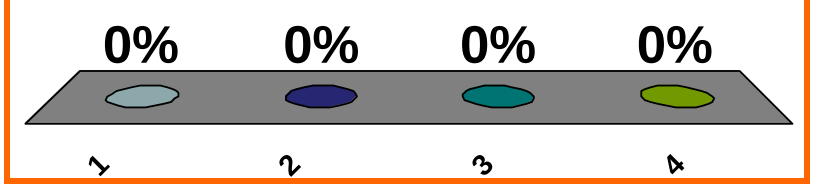
$$\dim \ker \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

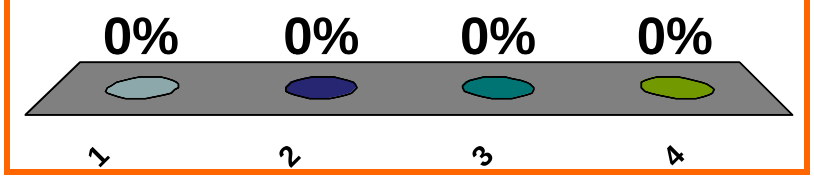
$$\dim \ker \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} =$$

(a) 0

(b) 1

(c) 2

(d) none of the above



0 of 5

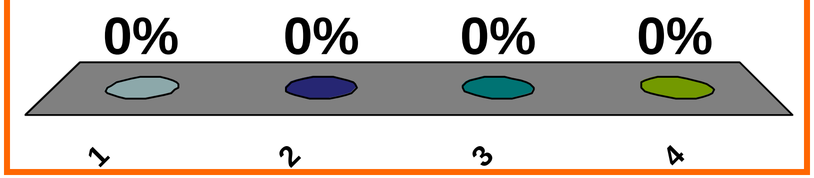
$$\det \begin{bmatrix} 3 & 1 & -4 \\ 0 & 6 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

(a) 10

(b) $\boxed{18}$

(c) $(18)(-4)$

(d) none of the above



0 of 5

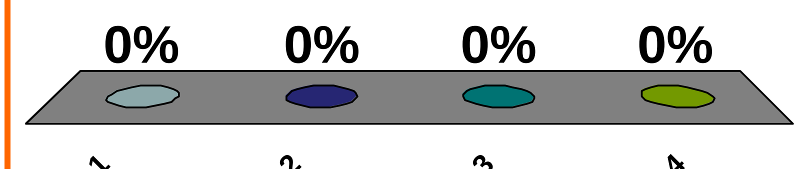
$$\det \begin{bmatrix} 1 & 1 & -6 \\ 0 & 2 & 3 \\ 0 & 0 & 7 \end{bmatrix}$$

(a) 0

(b) 10

(c) 14

(d) none of the above



0 of 5

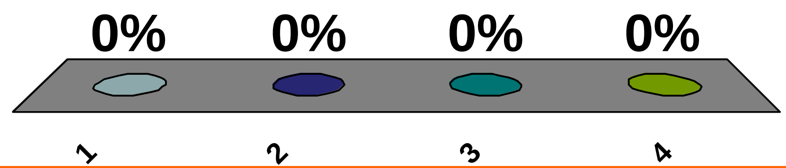
$$\det \begin{bmatrix} 1 & 0 & 0 \\ 3 & 2 & 0 \\ 6 & 9 & 7 \end{bmatrix}$$

$\boxed{\text{(a) } 14}$

(b) 0

(c) 10

(d) none of the above



0 of 5

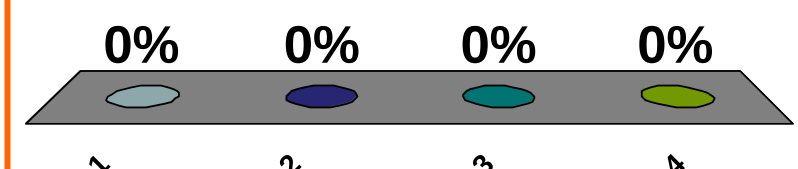
$$\det\begin{bmatrix} 3 & 1 & 0 \\ 0 & 6 & 0 \\ 17 & 0 & 1 \end{bmatrix}$$

(a) 10

(b) 18

(c) 0

(d) none of the above



0 of 5

$$\det \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ 5 & 4 & 2 \end{bmatrix}$$

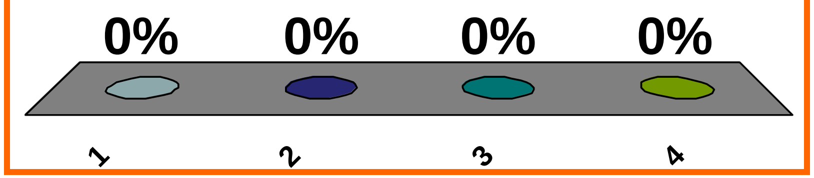
(a) 10

(b) 18

(c) -1

0

(d) none of the above



0 of 5

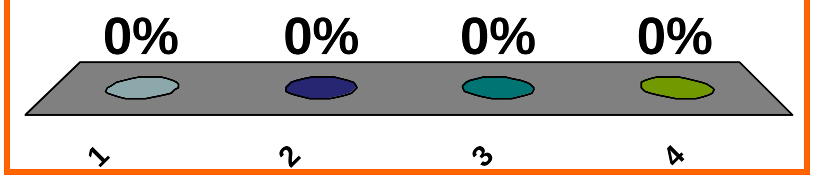
$$\det \begin{bmatrix} -1 & 3 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{bmatrix}$$

(a) 0

(b) 10

(c) 18

(d) none of the above



0 of 5

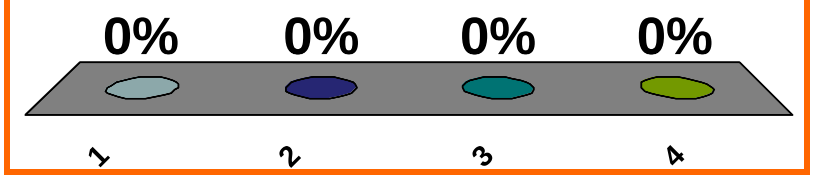
$$\det\begin{bmatrix} -1 & 3 & 1 \\ 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$$

(a) 10

(b) 0

(c) 18

(d) none of the above



0 of 5

$$\det \begin{bmatrix} -1 & 3 & 1 \\ 1 & 2 & 3 \\ 2 & 4 & 7 \end{bmatrix}$$

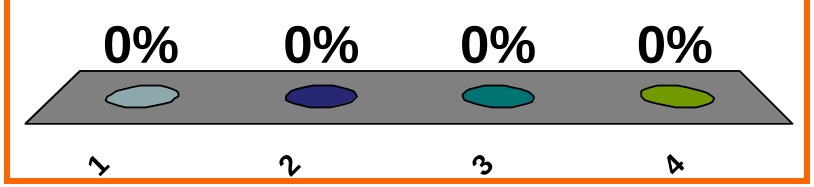
(a) 10

(b) 18

(c) 0

-5

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



0 of 5

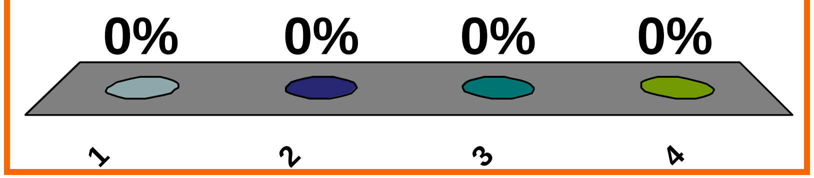
$$\det \begin{bmatrix} 3 & 6 & 1 \\ 5 & 10 & 3 \\ 5 & 10 & 7 \end{bmatrix}$$

(a) 10

(b) 18

(c) 0

(d) none of the above



0 of 5

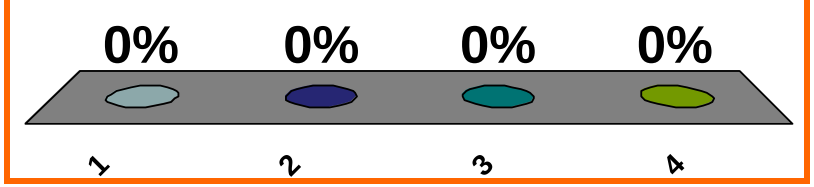
$$\det \begin{bmatrix} 3 & 0 & 0 \\ 5 & 11 & 6 \\ 7 & 10 & 3 \end{bmatrix}$$

(a) 99

(b) 0

(c) $(3)(33 - 60)$

(d) none of the above



0 of 5

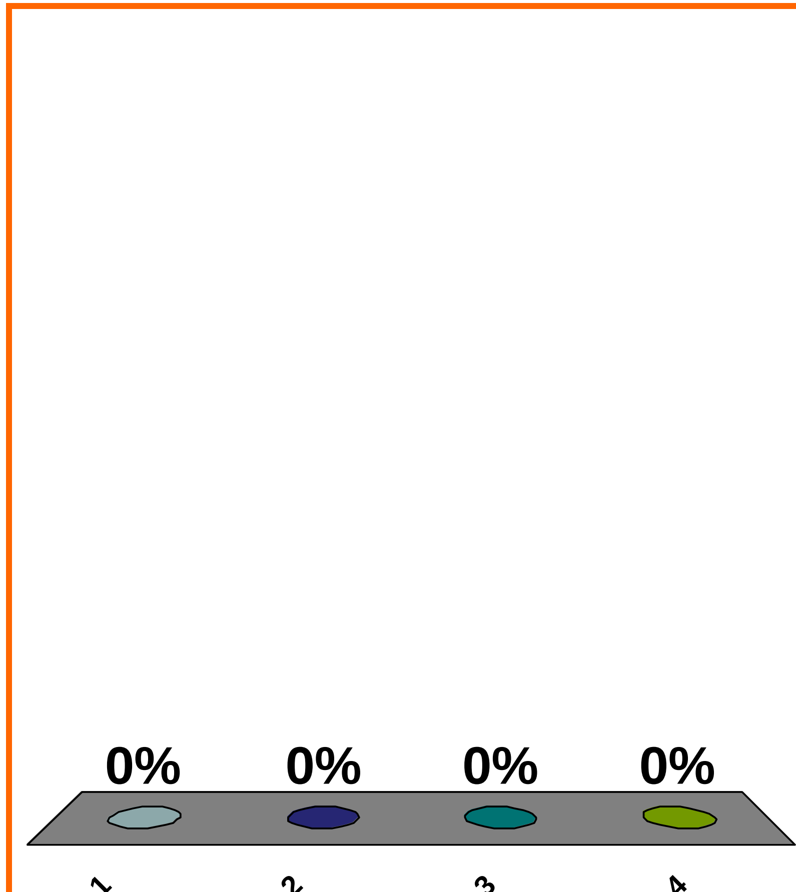
$$\det \begin{bmatrix} 0 & 3 & 0 \\ 5 & 11 & 6 \\ 7 & 10 & 3 \end{bmatrix}$$

(a) 0

(b) $(3)(15 - 42)$

(c) $\boxed{(-3)(15 - 42)}$

(d) none of the above



0 of 5

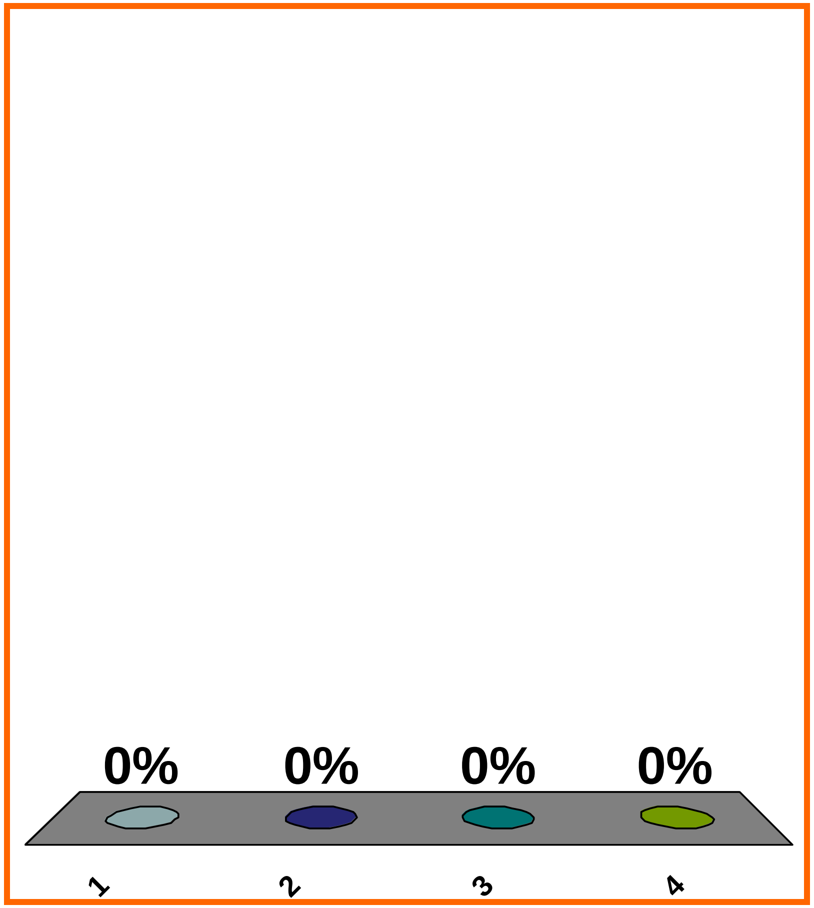
$$\det \begin{bmatrix} 7 & 10 & 3 \\ 5 & 11 & 6 \\ 0 & 3 & 0 \end{bmatrix}$$

(a) 0

(b) $(3)(42 - 15)$

(c) $(-3)(42 - 15)$

(d) none of the above



0 of 5

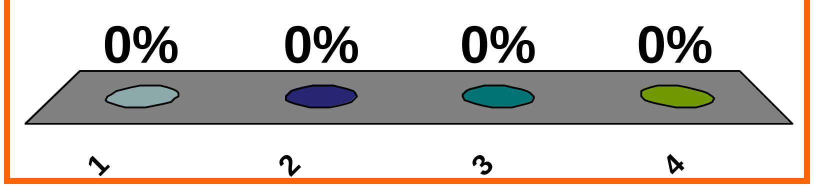
$$\det\begin{bmatrix} 7 & 10 & 3 \\ 0 & 3 & 0 \\ 5 & 11 & 6 \end{bmatrix}$$

(a) 0

(b) $(3)(42-15)$

(c) $(-3)(42-15)$

(d) none of the above



0 of 5

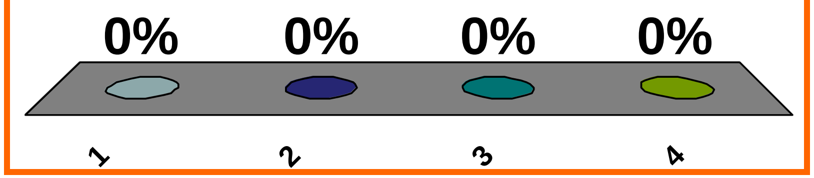
$$\mathrm{sv}\left(\begin{array}{l}(0,3,0),\\ (5,11,16),\\ (7,10,3)\end{array}\right)$$

(a) 0

(b) $(3)(15-42)$

(c) $\boxed{(-3)(15-42)}$

(d) none of the above



0 of 5

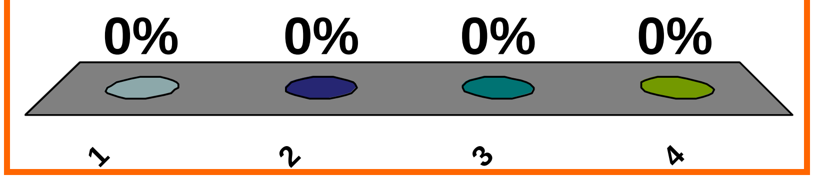
$$\text{sv}\left(\begin{array}{l}(7,10,3),\\(5,11,6),\\(0,3,0)\end{array}\right)$$

(a) 0

(b) $(3)(42-15)$

(c) $\boxed{(-3)(42-15)}$

(d) none of the above



0 of 5

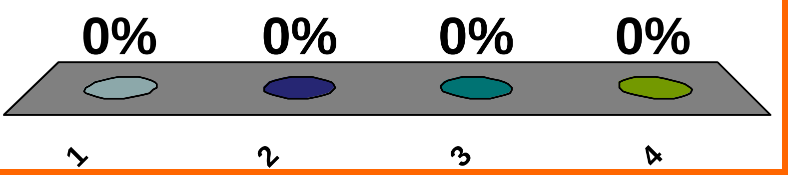
$$\text{sv}\left(\begin{array}{l}(7,10,3),\\ (0,3,0),\\ (5,11,6)\end{array}\right)$$

(a) 0

(b) $(3)(42-15)$

(c) $(-3)(42-15)$

(d) none of the above



0 of 5

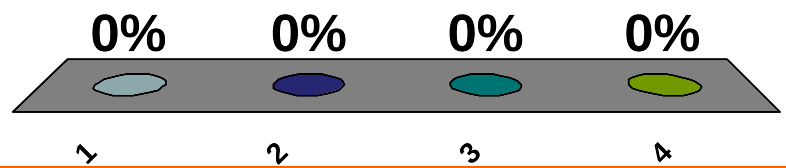
minors $\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$

(a) $\begin{bmatrix} 6 & 5 \\ 4 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 6 & 4 \\ 5 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 6 & -4 \\ -5 & 3 \end{bmatrix}$

(d) none of the above



0 of 5

$$\text{cofactor}\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$$

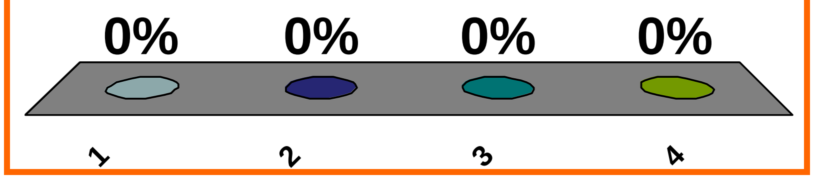
(a) $\begin{bmatrix} 6 & 5 \\ 4 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 6 & 4 \\ 5 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 6 & -4 \\ -5 & 3 \end{bmatrix}$

$$\begin{bmatrix} 6 & -5 \\ -4 & 3 \end{bmatrix}$$

(d) none of the above



0 of 5

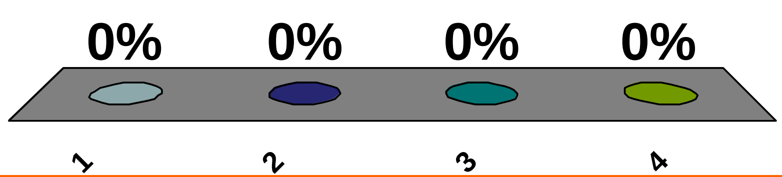
transposed cofactor $\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$

(a) $\begin{bmatrix} 6 & 5 \\ 4 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 6 & 4 \\ 5 & 3 \end{bmatrix}$

(c) $\boxed{\begin{bmatrix} 6 & -4 \\ -5 & 3 \end{bmatrix}}$

(d) none of the above



0 of 5

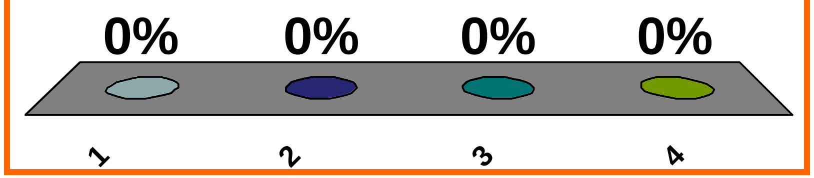
$$\text{minors} \begin{bmatrix} -5 & 1 \\ 6 & -8 \end{bmatrix}$$

(a) $\begin{bmatrix} -8 & -1 \\ -6 & -5 \end{bmatrix}$

(b) $\boxed{\begin{bmatrix} -8 & 6 \\ 1 & -5 \end{bmatrix}}$

(c) $\begin{bmatrix} -8 & -6 \\ -1 & -5 \end{bmatrix}$

(d) none of the above



0 of 5

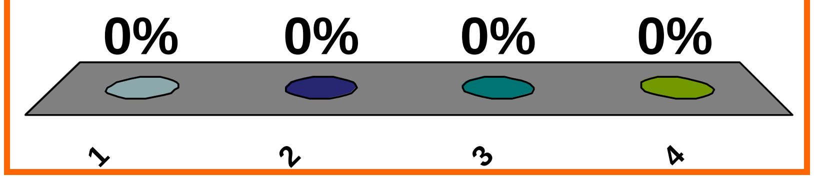
cofactor $\begin{bmatrix} -5 & 1 \\ 6 & -8 \end{bmatrix}$

(a) $\begin{bmatrix} -8 & -1 \\ -6 & -5 \end{bmatrix}$

(b) $\begin{bmatrix} -8 & 6 \\ 1 & -5 \end{bmatrix}$

(c) $\begin{bmatrix} -8 & -6 \\ -1 & -5 \end{bmatrix}$

(d) none of the above



0 of 5

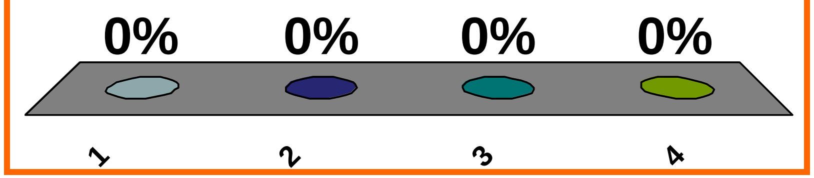
transposed cofactor $\begin{bmatrix} -5 & 1 \\ 6 & -8 \end{bmatrix}$

(a) $\begin{bmatrix} -8 & -1 \\ -6 & -5 \end{bmatrix}$

(b) $\begin{bmatrix} -8 & 6 \\ 1 & -5 \end{bmatrix}$

(c) $\begin{bmatrix} -8 & -6 \\ -1 & -5 \end{bmatrix}$

(d) none of the above



0 of 5

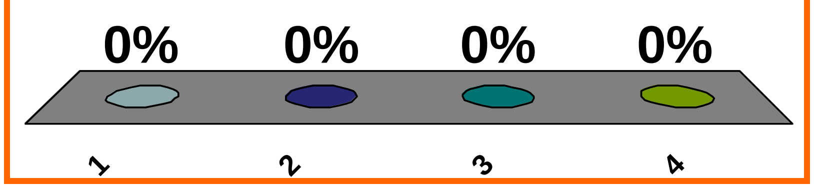
transposed cofactor $\begin{bmatrix} 8 & 7 \\ 6 & 5 \end{bmatrix}$

(a) $\begin{bmatrix} 5 & 7 \\ 6 & 8 \end{bmatrix}$

(b) $\boxed{\begin{bmatrix} 5 & -7 \\ -6 & 8 \end{bmatrix}}$

(c) $\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$

(d) none of the above



0 of 5

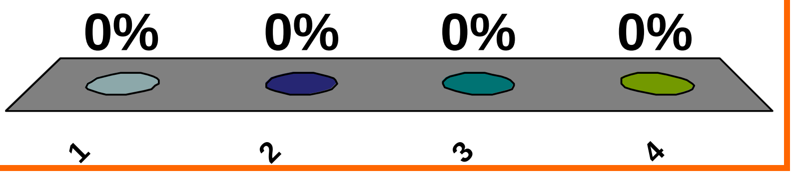
#monomials degree ≤ 4 in six variables

(a) $\binom{10}{4}$

(b) $\binom{6}{4}$

(c) $\binom{10}{3}$

(d) none of the above



0 of 5

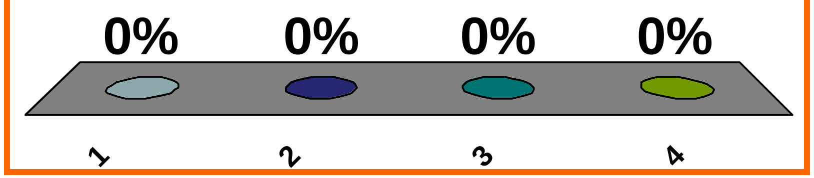
#monomials degree ≤ 7 in two variables

(a) $\binom{7}{2}$

(b) $\binom{9}{2}$

(c) $\binom{7}{3}$

(d) none of the above



0 of 5

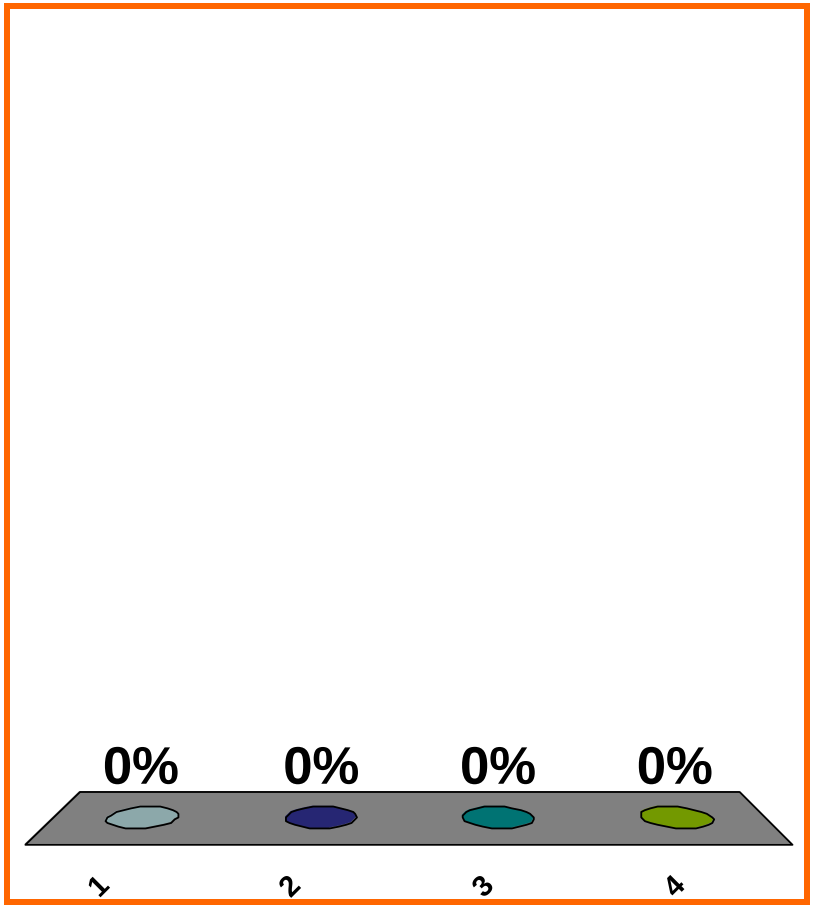
\#monomials degree ≤ 2 in seven variables

(a) $\binom{7}{2}$

(b) $\boxed{\binom{9}{2}}$

(c) $\binom{7}{3}$

(d) none of the above



0 of 5

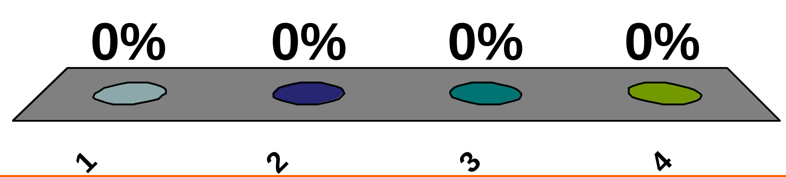
#monomials degree = 4 in eight variables

(a) $\binom{11}{8}$

(b) $\binom{8}{4}$

(c) $\binom{11}{4}$

(d) none of the above



0 of 5

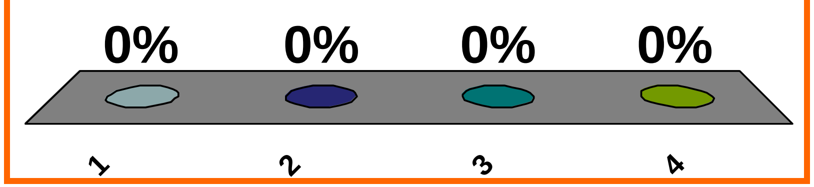
#monomials degree $= 6$ in four variables

(a) $\binom{9}{3}$

(b) $\binom{10}{4}$

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

(d) none of the above



0 of 5

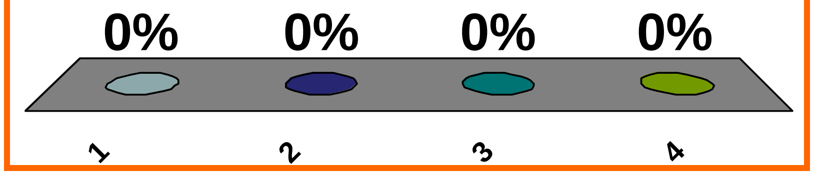
#monomials degree = 10
in five variables

(a) $\binom{14}{10}$

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

(c) $\binom{15}{5}$

(d) none of the above



0 of 5

#subsets of $\{1, 2, 3, 4, 5\}$ with two elements

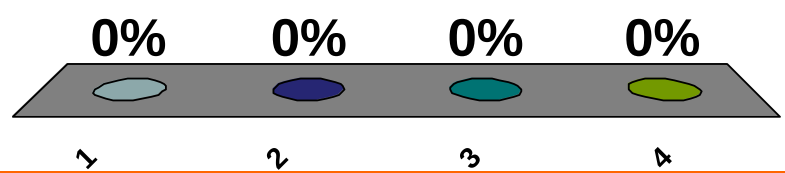
(a) $\binom{7}{2}$

(b) $\binom{4}{2}$

(c) $\binom{5}{5}$

(d) none of the above

$\binom{5}{2}$



0 of 5

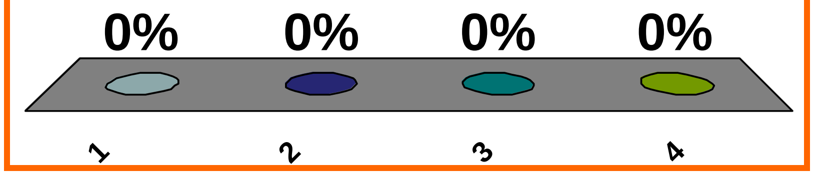
$\#$subsets of $\{1, 2, 3, 4\}$ with three elements

(a) $\binom{4}{0}$

(b) $\boxed{\binom{4}{1}}$

(c) $\binom{4}{2}$

(d) none of the above



0 of 5

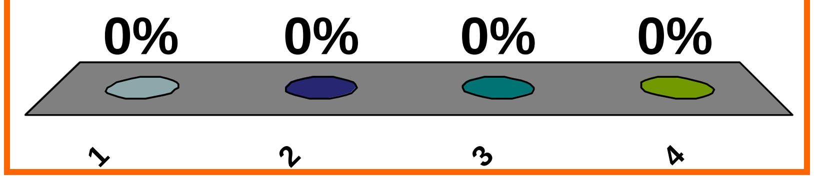
#subsets of $\{1,2,3,4\}$ with four elements

(a) $\binom{4}{0}$

(b) $\binom{4}{1}$

(c) $\binom{4}{2}$

(d) none of the above



0 of 5

trace of

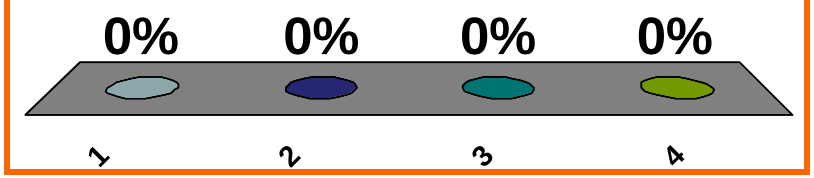
$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$

(a) -1

(b) $\boxed{4}$

(c) 8

(d) none of the above



0 of 5

determinant of

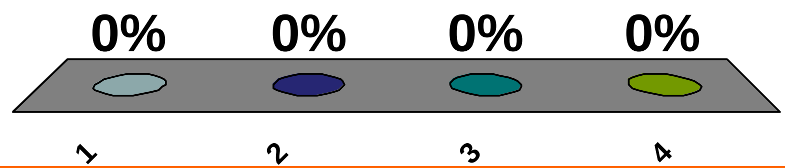
$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$

(a) -1

(b) 4

(c) 8

(d) none of the above



0 of 5

trace of

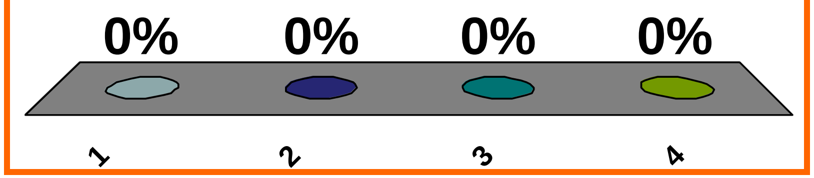
$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

(a) 14

(b) 7

(c) -2

(d) none of the above



0 of 5

determinant of

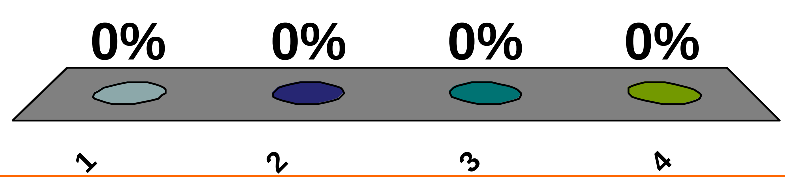
$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

(a) 14

(b) 7

(c) -2

(d) none of the above



0 of 5

char poly of
$$\begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$$

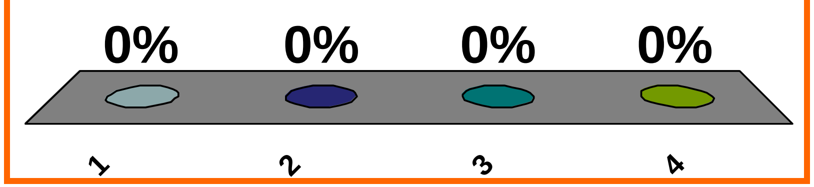
(a) $\lambda^2 + 7\lambda - 2$

(b) $\lambda^2 - 7\lambda + 2$

(c) $\lambda^2 + 2\lambda + 7$

(d) none of the above

$\lambda^2 - 7\lambda - 2$



0 of 5

char poly of
$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$

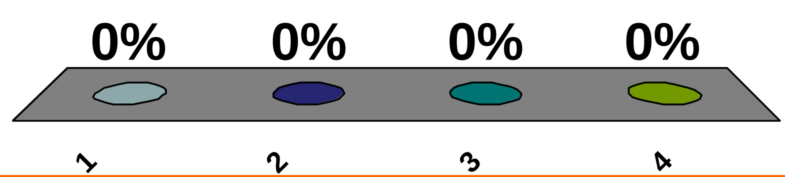
(a) $\lambda^2 - 4\lambda + 1$

(b) $\lambda^2 + 4\lambda + 1$

(c) $\lambda^2 + 4\lambda - 1$

(d) none of the above

$$\lambda^2 - 4\lambda - 1$$



0 of 5

eigenvalues of

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

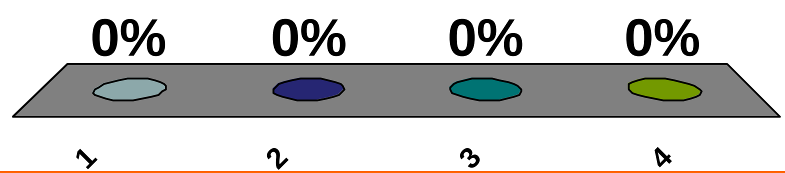
(Hint: $\lambda^2 - \lambda - 2$)

(a) $-1, 2$

(b) $1, 2$

(c) $1, -2$

(d) none of the above



0 of 5

eigenvalues of

$$\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$$

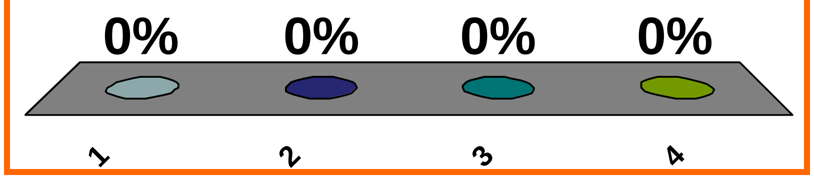
(Hint: $\lambda^2 + 7\lambda + 12$)

(a) $-3, 4$

(b) $3, 4$

(c) $3, -4$

(d) none of the above $\quad -3, -4$



0 of 5

eigenvalues of

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

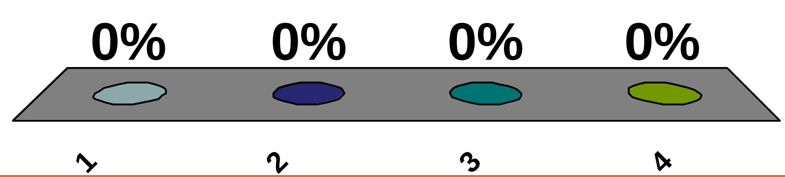
(Hint: $\lambda^2 + 3\lambda - 10$)

(a) $2, 5$

(b) $2, -5$

(c) $-2, 5$

(d) none of the above



0 of 5

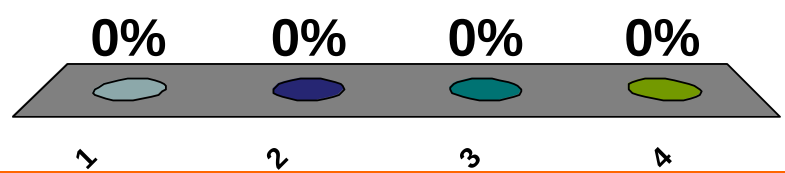
(-1)-eigenvector of $\begin{bmatrix} 0 & 2 \\ 1 & 1 \end{bmatrix}$

(a) $\begin{bmatrix} -2 \\ 2 \end{bmatrix}$

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

(c) $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$

$\boxed{\text{(d) none of the above}}$ $\begin{bmatrix} -2 \\ 1 \end{bmatrix}$ or a multiple



0 of 5

(-3)-eigenvector of $\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$

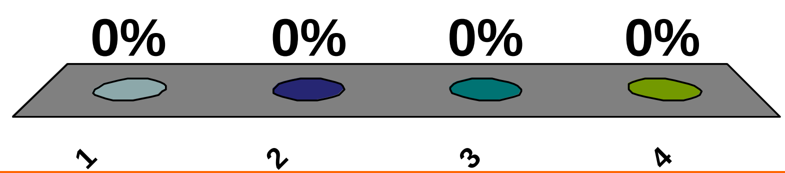
(a) $\begin{bmatrix} 2 \\ 2 \end{bmatrix}$

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

(c) $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$

(d) none of the above

$\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ or a multiple



0 of 5

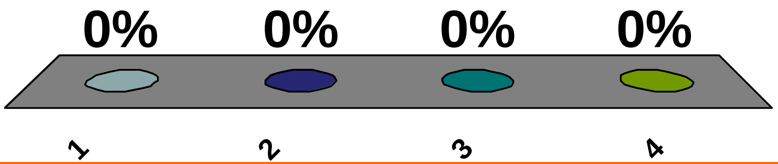
2-eigenvector of
$$\begin{bmatrix} -1 & 2 \\ 6 & -2 \end{bmatrix}$$

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

(b) $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$

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

(d) none of the above



0 of 5

tr-cof of

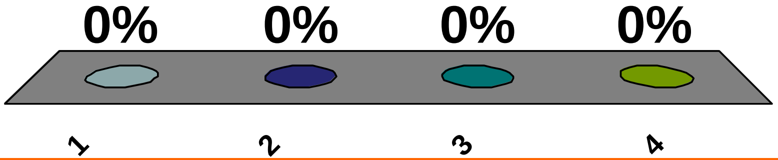
$$\begin{bmatrix} 0 & 2 \\ 1 & 1 \end{bmatrix}$$

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

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

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

(d) none of the above



0 of 5

tr-cof of

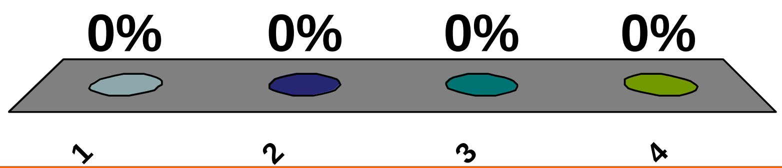
$$\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$$

(a) $\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$

(b) $\begin{bmatrix} -5 & -1 \\ 2 & -2 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & -1 \\ 2 & -5 \end{bmatrix}$

(d) none of the above



0 of 5

tr-cof of

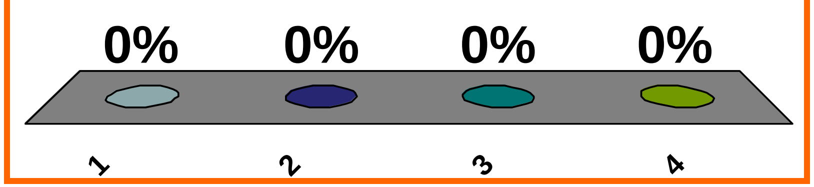
$$\begin{bmatrix} -1 & 2 \\ 6 & -2 \end{bmatrix}$$

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

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

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

(d) none of the above



0 of 5

inverse of

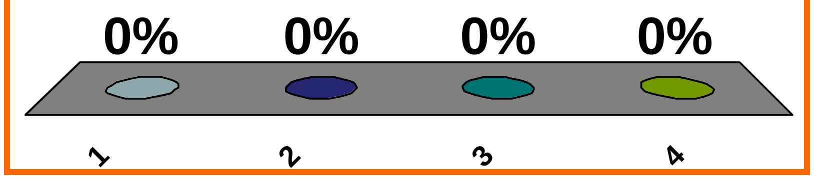
$$\begin{bmatrix} 0 & 2 \\ 1 & 1 \end{bmatrix}$$

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

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

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

(d) none of the above



0 of 5

inverse of

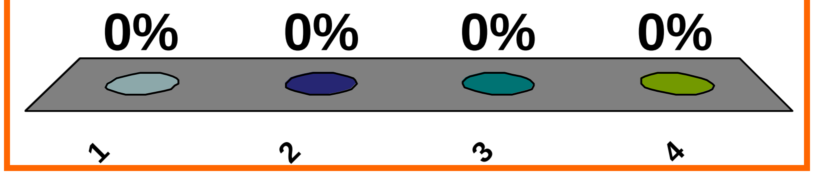
$$\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$$

(a) $\dfrac{1}{12}\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix}$

(b) $\dfrac{1}{12}\begin{bmatrix} -2 & -1 \\ 2 & -5 \end{bmatrix}$

(c) $\dfrac{1}{12}\begin{bmatrix} -5 & -1 \\ 2 & -2 \end{bmatrix}$

(d) none of the above



0 of 5

inverse of

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

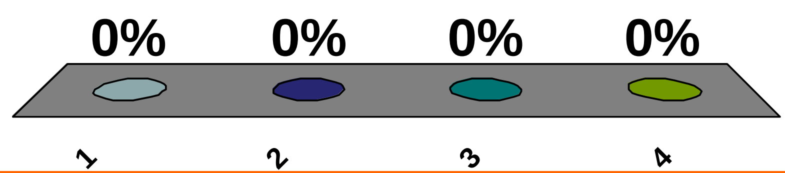
(a) $\frac{1}{10}\begin{bmatrix} -2 & -6 \\ -2 & -1 \end{bmatrix}$

(b) $\frac{1}{10}\begin{bmatrix} -2 & 2 \\ 6 & -1 \end{bmatrix}$

(c) $\frac{1}{10}\begin{bmatrix} -2 & -2 \\ -6 & -1 \end{bmatrix}$

(d) none of the above

$$-\frac{1}{10}\begin{bmatrix} -2 & -2 \\ -6 & -1 \end{bmatrix}$$



0 of 5

$$A := \begin{bmatrix} -1 & 2 \\ 6 & -2 \end{bmatrix} \qquad B := \begin{bmatrix} 4 & 1 \\ 0 & 4 \end{bmatrix}$$

$$C := A^{-1}BA$$

$$AC^{100}A^{-1} =$$

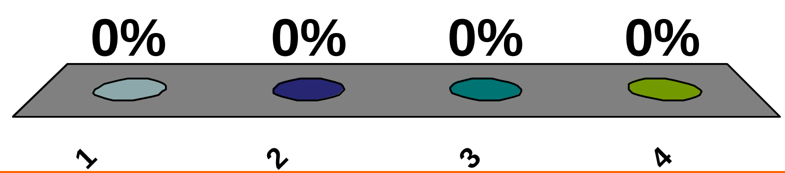
(a) $\begin{bmatrix} -1 & 2 \\ 6 & -2 \end{bmatrix} \begin{bmatrix} 4 & 1 \\ 0 & 4 \end{bmatrix}$

(b) $\begin{bmatrix} 4^{100} & 0 \\ 0 & 4^{100} \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 4^{100} & 0 \\ 0 & 4^{100} \end{bmatrix} \begin{bmatrix} 1 & 1/2 \\ 0 & 1 \end{bmatrix}$

(d) none of the above

$$\begin{bmatrix} 4^{100} & 100 \cdot 4^{99} \\ 0 & 4^{100} \end{bmatrix}$$



0 of 5

$$A := \begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix} \qquad B := \begin{bmatrix} 3 & 1 \\ 0 & 3 \end{bmatrix}$$

$$C := A^{-1}BA$$

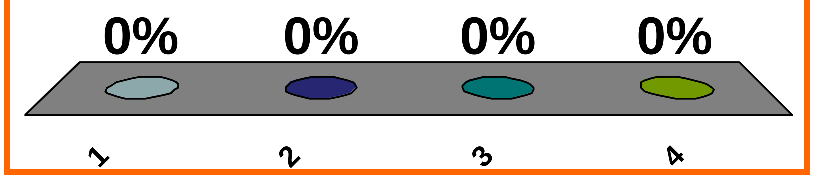
$$AC^{17}A^{-1} =$$

(a) $\begin{bmatrix} -5 & 1 \\ -2 & -2 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ 0 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 3^{17} & 0 \\ 0 & 3^{17} \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 3^{17} & 17 \cdot 3^{16} \\ 0 & 3^{17} \end{bmatrix}$

(d) none of the above



0 of 5

$$A := \begin{bmatrix} 0 & 2 \\ 1 & 1 \end{bmatrix} \qquad B := \begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix}$$

$$C := A^{-1}BA$$

$$AC^{25}A^{-1} =$$

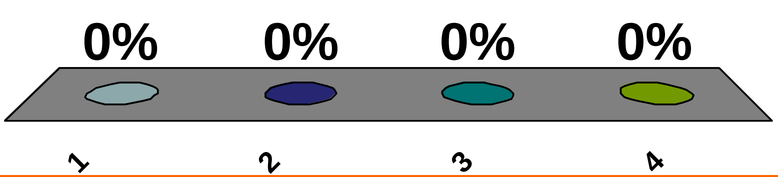
(a) $\begin{bmatrix} 7^{25} & 0 \\ 0 & 7^{25} \end{bmatrix} \begin{bmatrix} 1 & 25 \\ 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 0 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix}$

(c) $\begin{bmatrix} 7^{25} & 0 \\ 0 & 7^{25} \end{bmatrix} \begin{bmatrix} 1 & 25/2 \\ 0 & 1 \end{bmatrix}$

(d) none of the above

$$\begin{bmatrix} 7^{25} & 0 \\ 0 & 7^{25} \end{bmatrix}$$



0 of 5

Financial Mathematics

Regular review session, Final

Review definitions:

partition

$A = B \coprod C \coprod D$

closed, open, compact

dense

x_+, x_-

injective, surjective, bijective

upper bound, lower bound

supremum, infimum

maximum, minimum

$a_1 + a_2 + a_3 + \cdots = a$

rearrangments converge?

Review definitions:

injective, surjective, bijective
upper bound, lower bound
supremum, infimum
basis of a subspace
dimension of a subspace
linear transformation
image, kernel of a linear transformation
matrix of a linear transformation
quadratic form
matrix of a quadratic form
equivalence of quadratic forms
positive semidefinite, positive definite
oriented paralellogram, oriented parallelpiped
determinant
characteristic polynomial, eigenvalue
eigenvector, eigenspace

Definitions:

symmetric matrix
anti-symmetric matrix
nilpotent matrix
standard nilpotent matrix
scalar matrix
Jordan block
orthogonal matrix
rotation matrix
reflection matrix

$$B_N(v, w) =$$

$$Q_N(v) =$$

$$[B] =$$

$$[Q] =$$

Q form $\leftrightarrow$ SB form $\leftrightarrow$ symm matrix

Definitions:

jet in one-variable calc
jet in multi-variable calc
Maclaurin approximation

conjugate matrices
def'n of e^M
rotationally diagonalizable

Fact:

left inverse iff right inverse
iff injective iff surjective
iff nonzero determinant

Questions:

Can a nonsquare matrix have both
a left inverse and a right inverse?

Cayley's Theorem

Spectral Theorem

Can every matrix be made diagonal
through row operations?

How to check diagonalizability?

How to check diagonalizability
over the reals?

e.g.: diag over $\mathbb{C}$ but not over $\mathbb{R}$

e.g.: not diag over $\mathbb{C}$

Skills:

Sum $(A + B)$

Product (AB)

Direct sum $(A \oplus B)$

Tensor product $(A \otimes B)$

$$A = \begin{bmatrix} 2 & 7 \\ 3 & 6 \end{bmatrix}$$

$$\chi_A(\lambda) =$$

Skills:

Gram-Schmidt

e.g., $u_1 = (1,1)$, $u_2 = (2,3)$

Find o.n. v_1, v_2

s.t. u_1, u_2 and v_1, v_2 have the same flag.

$$w_1 =$$

$$v_1 =$$

$$w_2 = u_2 - ?v_1 \quad \perp \quad v_1$$

$$? =$$

$$w_2 =$$

$$v_2 =$$

Skills:

Inverse (A^{-1})

$$\begin{bmatrix} 0 & 1 & 0 \\ 2 & 4 & 5 \\ 1 & 7 & 3 \end{bmatrix}^{-1} = ??$$

Skills:

Exponentiating a matrix

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

Skills:

Exponentiating a matrix

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

Questions:

determinant of direct sum
of square matrices

product of direct sums
of square matrices

inverse of direct sum
of square matrices

Example of non-diagonalizable matrix

Example of complex diagonalizable matrix
that is NOT real diagonalizable

Skills:

Counting subsets with a given size.
Counting monomials of a given degree,
with a given number of variables
Row canonical, column canonical forms
Fully canonical form
Finding kernels and images
Finding dimensions of kernels and images
Finding inverses
Finding characteristic polynomial
Finding eigenvalues
Finding eigenspaces
i.e., bases of eigenspaces
PCA: KM has orthogonal rows
PCA: KML is diagonal

Skills:

Counting subsets with a given size.

Counting monomials of a given degree,
with a given number of variables

Finding eigenvalues

Finding eigenspaces
i.e., bases of eigenspaces

PCA: KM has orthogonal rows

PCA: KML is diagonal

Questions:

determinant of direct sum
of square matrices

product of direct sums
of square matrices

inverse of direct sum
of square matrices

Discussion:

What is a spanning set of a subspace?

Define linearly independent.

What is a basis of a subspace?

What is the the dimension of a subspace?

What is the determinant of a matrix?

What is the image of a matrix?

What is the kernel of a linear transformation?

What is the image of a linear transformation?

List all monomials of degree $= 4$ in x and y.

List all monomials of degree ≤ 4 in x and y.

List all monomials of degree $= 4$ in x, y, z.

A **homogeneous polynomial**
of degree k in $x_1, \ldots, x_n$
a linear combination of monomials
of degree k in $x_1, \ldots, x_n$.

A **monomial**
of degree k in $x_1, \ldots, x_n$
is an expression of the form

$$x_{i_1} \cdots x_{i_k},$$

with $i_1, \ldots, i_k \in \{1, \ldots, n\}$.

A **monomial**
of degree k in $x_1, \ldots, x_n$
is an expression of the form

$$x_1^{e_1} \cdots x_n^{e_n},$$

with $e_1, \ldots, e_n \geq 0$ integers
and $e_1 + \cdots + e_n = k$.

Q: How many monomials are there of degree $\leq k$ in $x_1, \ldots, x_n$?

A: $\binom{n+k}{k} = \binom{n+k}{n}$

Q: How many monomials are there of degree $= k$ in $x_1, \ldots, x_n$?

A: $\binom{n+k}{k} - \binom{n+k-1}{k-1} = \binom{n+k-1}{k}$

A **monomial** **of degree** k **in** $x_1, \ldots, x_n$ is an expression of the form

$$x_1^{e_1} \cdots x_n^{e_n},$$

with $e_1, \ldots, e_n$ positive integers and $e_1 + \cdots + e_n = k$.

Q: How many monomials are there of degree $\leq k$ in $x_1, \ldots, x_n$?

A: $$\binom{n+k}{k} = \binom{n+k}{n}$$

Q: How many monomials are there of degree k in $x_1, \ldots, x_n$?

A: $$\binom{n+k}{k} - \binom{n+k-1}{k-1} = \binom{n+k-1}{k}$$

Q: Inside a set of n elements, how many k element subsets are there?

A: $$\binom{n}{k} = \frac{n!}{[k!][(n-k)!]}$$

Review definitions:

orthogonal
quadratic form
matrix of a quadratic form
equivalence of quadratic forms
positive semidefinite, positive definite

Questions:

Cayley's Theorem

Spectral Theorem

How to check diagonalizability?

How to check diagonalizability over the reals?

Example of non-diagonalizable matrix

Example of complex diagonalizable matrix that is NOT real diagonalizable