johnston-linear-matrix-algebra: residuals

equations measured 2026-09-05T12:23:12Z against the model of 2026-09-01

Corrected (8)

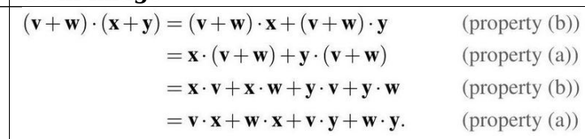
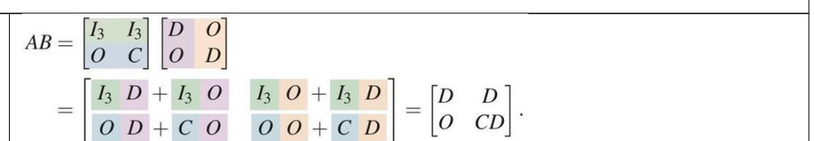
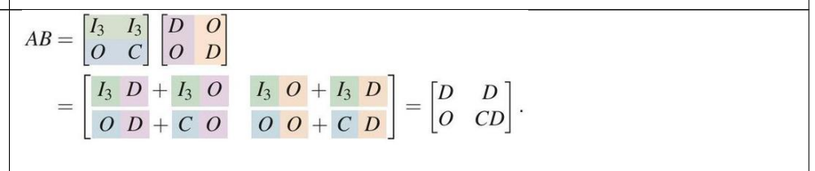
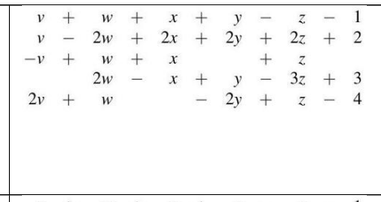
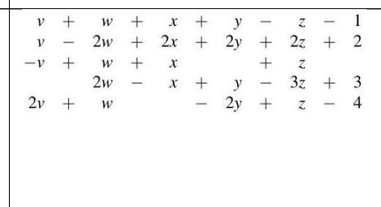
Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
johnston-linear-matrix-algebra_EQ0006 (was)	22	■ 0.141	\begin{array}{rlrl} & & \mathbf{x}+2(\mathbf{v}+\mathbf{w}) & =-\mathbf{v}-3(\mathbf{x}-\mathbf{w}) \\ \Longrightarrow & \mathbf{x}+2 \mathbf{v}+2 \mathbf{w} & =-\mathbf{v}-3 \mathbf{x}+3 \mathbf{w} & \\ \Longrightarrow & 4 \mathbf{x} & =-3 \mathbf{v}+ \mathbf{w} & \\ \Longrightarrow & \mathbf{x} & =\frac{1}{4}(\mathbf{w}-3 \mathbf{v}) . & \\ \Longrightarrow & \text { (divide both sides by } 4) & & \end{array}	$$\begin{array}{rlrl} & & \mathbf{x}+2(\mathbf{v}+\mathbf{w}) & =-\mathbf{v}-3(\mathbf{x}-\mathbf{w}) \\ \Longrightarrow & \mathbf{x}+2\mathbf{v}+2\mathbf{w} & =-\mathbf{v}-3\mathbf{x}+3\mathbf{w} & \\ \Longrightarrow & 4\mathbf{x} & =-3\mathbf{v}+\mathbf{w} & \\ \Longrightarrow & \mathbf{x} & =\tfrac{1}{4}(\mathbf{w}-3\mathbf{v}). & \\ \Longrightarrow & \text{(divide both sides by } 4) & & \end{array}$$	$$\begin{aligned} & \mathbf{x}+2(\mathbf{v}+\mathbf{w})=-\mathbf{v}-3(\mathbf{x}-\mathbf{w}) & & \\ \Longrightarrow\quad & \mathbf{x}+2\mathbf{v}+2\mathbf{w}=-\mathbf{v}-3\mathbf{x}+3\mathbf{w} & & \text{(expand parentheses)} \\ \Longrightarrow\quad & 4\mathbf{x}=-3\mathbf{v}+\mathbf{w} & & \text{(add } 3\mathbf{x}\text{, subtract } 2\mathbf{v}+2\mathbf{w}) \\ \Longrightarrow\quad & \mathbf{x}=\tfrac{1}{4}(\mathbf{w}-3\mathbf{v}). & & \text{(divide both sides by 4)} \end{aligned}$$
johnston-linear-matrix-algebra_EQ0006 (now)	22	—	\begin{array}{rll} & \mathbf{x}+2(\mathbf{v}+\mathbf{w}) = -\mathbf{v}-3(\mathbf{x}-\mathbf{w}) & \\ \Longrightarrow & \mathbf{x}+2\mathbf{v}+2\mathbf{w} = -\mathbf{v}-3\mathbf{x}+3\mathbf{w} & \text{(expand parentheses)} \\ \Longrightarrow & 4\mathbf{x} = -3\mathbf{v}+\mathbf{w} & \text{(add } 3\mathbf{x}\text{, subtract } 2\mathbf{v}+2\mathbf{w}) \\ \Longrightarrow & \mathbf{x} = \tfrac{1}{4}(\mathbf{w}-3\mathbf{v}). & \text{(divide both sides by 4)} \end{array}	$$\begin{aligned} & \mathbf{x}+2(\mathbf{v}+\mathbf{w})=-\mathbf{v}-3(\mathbf{x}-\mathbf{w}) & & \\ \Longrightarrow\quad & \mathbf{x}+2\mathbf{v}+2\mathbf{w}=-\mathbf{v}-3\mathbf{x}+3\mathbf{w} & & \text{(expand parentheses)} \\ \Longrightarrow\quad & 4\mathbf{x}=-3\mathbf{v}+\mathbf{w} & & \text{(add } 3\mathbf{x}\text{, subtract } 2\mathbf{v}+2\mathbf{w}) \\ \Longrightarrow\quad & \mathbf{x}=\tfrac{1}{4}(\mathbf{w}-3\mathbf{v}). & & \text{(divide both sides by 4)} \end{aligned}$$
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ0014 (was)	27	■ 0.071	\left.\begin{array}{rl} (\mathbf{v}+\mathbf{w}) \cdot(\mathbf{x}+\mathbf{y}) & =(\mathbf{v}+\mathbf{w}) \cdot \mathbf{x}+(\mathbf{v}+\mathbf{w}) \cdot \mathbf{y} \\ & =\mathbf{x} \cdot(\mathbf{v}+\mathbf{w})+\mathbf{y} \cdot(\mathbf{v}+\mathbf{w}) \\ & =\mathbf{x} \cdot \mathbf{v}+\mathbf{x} \cdot \mathbf{w}+\mathbf{y} \cdot \mathbf{v}+\mathbf{y} \cdot \mathbf{w} \\ & =\mathbf{v} \cdot \mathbf{x}+\mathbf{w} \cdot \mathbf{x}+\mathbf{v} \cdot \mathbf{y}+\mathbf{w} \cdot \mathbf{y} \end{array}\right(\text { property (broperty (a) })\right)	$$\left.\begin{array}{rl} (\mathbf{v}+\mathbf{w}) \cdot (\mathbf{x}+\mathbf{y}) & =(\mathbf{v}+\mathbf{w}) \cdot \mathbf{x}+(\mathbf{v}+\mathbf{w}) \cdot \mathbf{y} \\ & =\mathbf{x} \cdot (\mathbf{v}+\mathbf{w})+\mathbf{y} \cdot (\mathbf{v}+\mathbf{w}) \\ & =\mathbf{x} \cdot \mathbf{v}+\mathbf{x} \cdot \mathbf{w}+\mathbf{y} \cdot \mathbf{v}+\mathbf{y} \cdot \mathbf{w} \\ & =\mathbf{v} \cdot \mathbf{x}+\mathbf{w} \cdot \mathbf{x}+\mathbf{v} \cdot \mathbf{y}+\mathbf{w} \cdot \mathbf{y} \end{array}\right(\text{ property (broperty (a))})$$	$$\begin{aligned} (\mathbf{v}+\mathbf{w})\cdot(\mathbf{x}+\mathbf{y}) &= (\mathbf{v}+\mathbf{w})\cdot\mathbf{x}+(\mathbf{v}+\mathbf{w})\cdot\mathbf{y} && \text{(property (b))} \\ &= \mathbf{x}\cdot(\mathbf{v}+\mathbf{w})+\mathbf{y}\cdot(\mathbf{v}+\mathbf{w}) && \text{(property (a))} \\ &= \mathbf{x}\cdot\mathbf{v}+\mathbf{x}\cdot\mathbf{w}+\mathbf{y}\cdot\mathbf{v}+\mathbf{y}\cdot\mathbf{w} && \text{(property (b))} \\ &= \mathbf{v}\cdot\mathbf{x}+\mathbf{w}\cdot\mathbf{x}+\mathbf{v}\cdot\mathbf{y}+\mathbf{w}\cdot\mathbf{y}. && \text{(property (a))} \end{aligned}$$

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

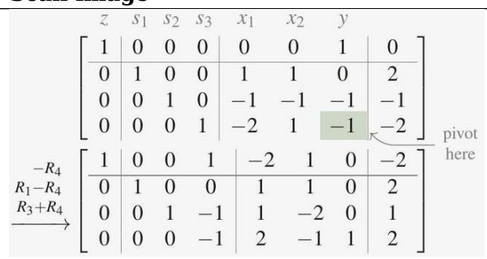
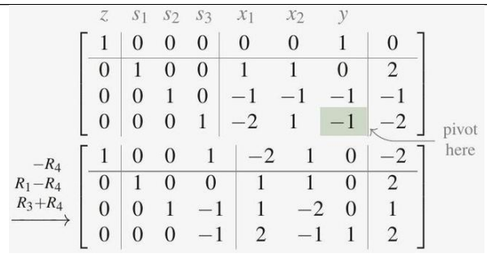
Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
johnston-linear-matrix-algebra_EQ0014 (now)	27	—	`\begin{array}{rl} (\mathbf{v}+\mathbf{w}) \cdot(\mathbf{x}+\mathbf{y}) =(\mathbf{v}+\mathbf{w}) \cdot \mathbf{x}+(\mathbf{v}+\mathbf{w}) \cdot \mathbf{y} & (\text{property (b)})\\ = \mathbf{x} \cdot(\mathbf{v}+ \mathbf{w})+\mathbf{y} \cdot(\mathbf{v}+\mathbf{w}) & (\text{property (a)})\\ = \mathbf{x} \cdot \mathbf{v}+ \mathbf{x} \cdot \mathbf{w}+\mathbf{y} \cdot \mathbf{v}+ \mathbf{y} \cdot \mathbf{w} & (\text{property (b)})\\ = \mathbf{v} \cdot \mathbf{x}+\mathbf{w} \cdot \mathbf{x}+ \mathbf{v} \cdot \mathbf{y}+\mathbf{w} \cdot \mathbf{y}. & (\text{property (a)}) \end{array}`	$$\begin{aligned}(\mathbf{v}+\mathbf{w})\cdot(\mathbf{x}+\mathbf{y}) &= (\mathbf{v}+\mathbf{w})\cdot\mathbf{x}+(\mathbf{v}+\mathbf{w})\cdot\mathbf{y} && \text{(property (b))}\\ &= \mathbf{x}\cdot(\mathbf{v}+\mathbf{w})+\mathbf{y}\cdot(\mathbf{v}+\mathbf{w}) && \text{(property (a))}\\ &= \mathbf{x}\cdot\mathbf{v}+\mathbf{x}\cdot\mathbf{w}+\mathbf{y}\cdot\mathbf{v}+\mathbf{y}\cdot\mathbf{w} && \text{(property (b))}\\ &= \mathbf{v}\cdot\mathbf{x}+\mathbf{w}\cdot\mathbf{x}+\mathbf{v}\cdot\mathbf{y}+\mathbf{w}\cdot\mathbf{y}. && \text{(property (a))}\end{aligned}$$	
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ0063 (was)	45	■ 0.136	`\begin{aligned} A B & =\left[\begin{array}{ll} I_{3} & I_{3} \\ O & C \end{array}\right]\left[\begin{array}{ll} D & O \\ O & D \end{array}\right] \\ & \left.=\left[\begin{array}{ll} I_{3} & D+I_{3} \end{array}\right] \quad \text { O } \quad \begin{array}{ll} I_{3} & O+I_{3} \\ O & D+C \\ O \end{array} \quad \begin{array}{ll} O & O+C \\ O \end{array}\right]=\left[\begin{array}{cc} D & D \\ O & C D \end{array}\right] . \end{aligned}`	$$\begin{aligned} AB &= \left[\begin{array}{ll} I_3 & I_3 \\ O & C \end{array}\right]\left[\begin{array}{ll} D & O \\ O & D \end{array}\right] \\ &= \left[\begin{array}{ll} I_3 D + I_3 O & I_3 O + I_3 D \\ O D + C O & O O + C D \end{array}\right] = \left[\begin{array}{ll} D & D \\ O & CD \end{array}\right]. \end{aligned}$$	
johnston-linear-matrix-algebra_EQ0063 (now)	45	—	`\begin{aligned} \Longrightarrow \quad 4\mathbf{x} &= -3\mathbf{v} + \mathbf{w} \qquad &&\text{(add $3 \mathbf{x}$, subtract $2\mathbf{v}$)} \\ \Longrightarrow \quad \mathbf{x} &= \tfrac{1}{4}(\mathbf{w} - 3 \mathbf{v}). \qquad &&\text{(divide both sides by $4$)} \end{aligned}`	$$\begin{aligned} \Longrightarrow \quad 4\mathbf{x} &= -3\mathbf{v} + \mathbf{w} && \text{(add } 3\mathbf{x}\text{, subtract } 2\mathbf{v}\text{)} \\ \Longrightarrow \quad \mathbf{x} &= \tfrac{1}{4}(\mathbf{w} - 3\mathbf{v}). && \text{(divide both sides by } 4\text{)} \end{aligned}$$	
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ0486 (was)	196	■ 0.011	`\begin{array}{rrrrrrrr} v & + & w & + & x & + & y & - \\ v & - & 2 w & + & 2 x & + & 2 y & + \\ -v & + & w & + & x & & & + \\ & & & + & z & & & \\ 2w & & - & x & + & y & - & 3z \\ 2v & & & - & 2y & + & z & - \end{array}`	$$\begin{array}{rrrrrrrr} v & + & w & + & x & + & y & - \\ v & - & 2w & + & 2x & + & 2y & + \\ -v & + & w & + & x & & & + \\ & & & + & z & & & \\ 2w & & - & x & + & y & - & 3z \\ 2v & & & - & 2y & + & z & - \end{array}$$	
johnston-linear-matrix-algebra_EQ0486 (now)	196	—	`\begin{array}{r c r c r c r c r c r} v & + & w & + & x & + & y & - & z & - & 1 \\ v & - & 2w & + & 2x & + & 2y & + & 2z & + & 2 \\ -v & + & w & + & x & & & + & z & & \\ & & 2w & - & x & + & y & - & 3z & + & 3 \\ 2v & + & w & & & - & 2y & + & z & - & 4 \end{array}`	$$\begin{array}{rrrrrrrrrrr} v & + & w & + & x & + & y & - & z & - & 1 \\ v & - & 2w & + & 2x & + & 2y & + & 2z & + & 2 \\ -v & + & w & + & x & & & + & z & & \\ & & 2w & - & x & + & y & - & 3z & + & 3 \\ 2v & + & w & & & - & 2y & + & z & - & 4 \end{array}$$	
basis: inferred / ink					

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

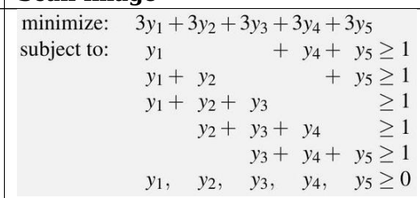
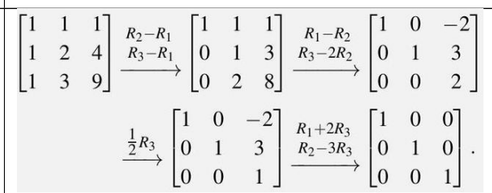
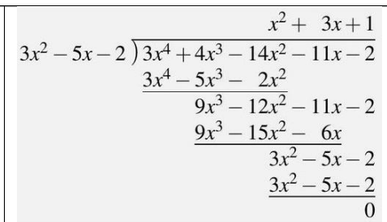
Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
johnston-linear-matrix-algebra_EQ0528 (was)	212	■ 0.001	\begin{array}{r} \\ \left.\xrightarrow{\begin{array}{c} z \\ R_{1} \end{array}} \begin{array}{c} S_{2} \quad S_{3} \\ R_{3}+R_{4} \\ R_{4}+R_{4} \\ \hline 0 \\ 0 \\ 0 \end{array} \left\lvert\, \begin{array}{c|cccc|c} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{array} \right.\begin{array}{c|ccc|ccc} 1 & 0 & 0 & 1 & -2 & 1 & 0 \\ \hline 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 & 1 & -2 & 0 \\ 0 & 0 & 0 & -1 & 2 & -1 & 1 \end{array} \begin{array}{c} \\ \\ 2 \\ \text{pivot} \end{array} \right]	$\begin{array}{r} \\ \left.\xrightarrow{\begin{array}{c} z \\ R_{1} \end{array}} \begin{array}{c} S_{2} \quad S_{3} \\ R_{3}+R_{4} \\ R_{4}+R_{4} \\ \hline 0 \\ 0 \\ 0 \end{array} \right\lvert\, \begin{array}{c\|cccc\|c} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{array} \begin{array}{c\|ccc\|ccc} 1 & 0 & 0 & 1 & -2 & 1 & 0 \\ \hline 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 & 1 & -2 & 0 \\ 0 & 0 & 0 & -1 & 2 & -1 & 1 \end{array} \begin{array}{c} \\ \\ 2 \\ \text{pivot} \end{array} \right]$	
johnston-linear-matrix-algebra_EQ0528 (now)	212	—	\xrightarrow{\begin{array}{c}z\\R_1\end{array}} \begin{array}{c}S_2\quad S_3\\R_3+R_4\\R_4+R_4\end{array} \left[\begin{array}{c|ccc|ccc|c}1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 0 & 1 & 0 & -1 & -1 & -1 & -1 \\ 0 & 0 & 0 & 1 & -2 & 1 & -1 & -2 \end{array}\right] \curvearrowright \text{pivot here} \xrightarrow{\begin{array}{c}-R_4\\R_1-R_4\\R_3+R_4\end{array}} \left[\begin{array}{c|ccc|ccc|c}1 & 0 & 0 & 1 & -2 & 1 & 0 & -2 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 0 & 1 & -1 & 1 & -2 & 0 & 1 \\ 0 & 0 & 0 & -1 & 2 & -1 & 1 & 2 \end{array}\right]	$\xrightarrow{\begin{array}{c}z\\R_1\end{array}} \begin{array}{c}S_2\quad S_3\\R_3+R_4\\R_4+R_4\end{array} \left[\begin{array}{c\|ccc\|ccc\|c}1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 0 & 1 & 0 & -1 & -1 & -1 & -1 \\ 0 & 0 & 0 & 1 & -2 & 1 & -1 & -2 \end{array}\right] \curvearrowright \text{pivot here} \xrightarrow{\begin{array}{c}-R_4\\R_1-R_4\\R_3+R_4\end{array}} \left[\begin{array}{c\|ccc\|ccc\|c}1 & 0 & 0 & 1 & -2 & 1 & 0 & -2 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 2 \\ 0 & 0 & 1 & -1 & 1 & -2 & 0 & 1 \\ 0 & 0 & 0 & -1 & 2 & -1 & 1 & 2 \end{array}\right]$	
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ0543 (was)	218	■ 0.103	\begin{array}{rlrl} \operatorname{minimize}: & 3 y_{1}+3 y_{2}+3 y_{3}+3 y_{4}+3 y_{5} & \\ \text { subject to: } & y_{1}+y_{4}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{3} & \geq 1 \\ & y_{2}+y_{3}+y_{4} & \geq 1 \\ & y_{3}+y_{4}+y_{5} & \geq 1 \\ y_{2}, & y_{3}, \quad y_{4}, \quad y_{5} & \geq 0 \end{array}	$\begin{array}{rlrl} \operatorname{minimize}: & 3 y_{1}+3 y_{2}+3 y_{3}+3 y_{4}+3 y_{5} & \\ \text { subject to: } & y_{1}+y_{4}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{3} & \geq 1 \\ & y_{2}+y_{3}+y_{4} & \geq 1 \\ & y_{3}+y_{4}+y_{5} & \geq 1 \\ y_{2}, & y_{3}, \quad y_{4}, \quad y_{5} & \geq 0 \end{array}$	$\begin{array}{rlrl} \operatorname{minimize}: & 3 y_{1}+3 y_{2}+3 y_{3}+3 y_{4}+3 y_{5} & \\ \text { subject to: } & y_{1}+y_{4}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{5} & \geq 1 \\ & y_{1}+y_{2}+y_{3} & \geq 1 \\ & y_{2}+y_{3}+y_{4} & \geq 1 \\ & y_{3}+y_{4}+y_{5} & \geq 1 \\ y_{2}, & y_{3}, \quad y_{4}, \quad y_{5} & \geq 0 \end{array}$

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): • C component • W weak • S stable • N noise • K clean • not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

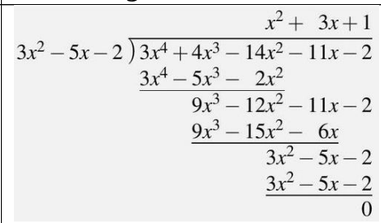
Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
johnston-linear-matrix-algebra_EQ0543 (now)	218	—	`v = (6, 3, 3), (-2, 0, 6) = (8, 3, 0)`	$v = (6,3,3), (-2,0,6) = (8,3,0)$	
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ0748 (was)	283	0.116	`\begin{aligned} {\left[\begin{array}{lll} 1 & 1 & 1 \\ 1 & 2 & 4 \\ 1 & 3 & 9 \end{array}\right] } & \xrightarrow{\substack{R_{2}-R_{1} \\ R_{3}-R_{1}}} \left[\begin{array}{lll} 1 & 1 & 1 \\ \ 0 & 1 & 3 \\ 0 & 2 & 8 \end{array}\right] \\ & \xrightarrow{\substack{R_{1}-R_{2} \\ R_{3}-2 R_{2}}}\left[\begin{array}{ccc} 1 & 0 & -2 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{array}\right] \\ \frac{\frac{1}{2}}{2} R_{3}\left[\begin{array}{ccc} 1 & 0 & -2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{array}\right] & \xrightarrow{\substack{R_{1}+2 R_{3} \\ R_{2}-3 R_{3}}}\left[\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array}\right] . \end{aligned}`	$\begin{aligned} \left[\begin{array}{lll} 1 & 1 & 1 \\ 1 & 2 & 4 \\ 1 & 3 & 9 \end{array}\right] & \xrightarrow{\substack{R_{2}-R_{1} \\ R_{3}-R_{1}}} \left[\begin{array}{lll} 1 & 1 & 1 \\ \ 0 & 1 & 3 \\ 0 & 2 & 8 \end{array}\right] \\ & \xrightarrow{\substack{R_{1}-R_{2} \\ R_{3}-2 R_{2}}}\left[\begin{array}{ccc} 1 & 0 & -2 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{array}\right] \\ \frac{\frac{1}{2}}{2} R_{3}\left[\begin{array}{ccc} 1 & 0 & -2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{array}\right] & \xrightarrow{\substack{R_{1}+2 R_{3} \\ R_{2}-3 R_{3}}}\left[\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array}\right] . \end{aligned}$	
johnston-linear-matrix-algebra_EQ0748 (now)	283	—	`\mathbf{w} = (6,3,-3) - (-2,0,6) = (8,3,-9).`	$\mathbf{w} = (6,3,-3) - (-2,0,6) = (8,3,-9).$	
basis: inferred / ink					
johnston-linear-matrix-algebra_EQ1276 (was)	427	0.022	`\left.3 x ^ { 2 } - 5 x - 2 \longdiv { \frac { x ^ { 2 } + 3 x + 1 } { 3 x ^ { 4 } + 4 x ^ { 3 } - 1 4 x ^ { 2 } - 1 1 x - 2 } }, \frac{3 x^{4}-5 x^{3}-2 x^{2}}{9 x^{3}-12 x^{2}-11 x-2}, 2, \frac{9 x^{3}-15 x^{2}-6 x}{3 x^{2}-5 x-2}, 3 \frac{3 x^{2}-5 x-2}{0}\right)`	$3x^{2}-5x-2\overline{)\frac{x^{2}+3x+1}{3x^{4}+4x^{3}-14x^{2}-11x-2}}, \frac{3x^{4}-5x^{3}-2x^{2}}{9x^{3}-12x^{2}-11x-2}, 2, \frac{9x^{3}-15x^{2}-6x}{3x^{2}-5x-2}, 3\frac{3x^{2}-5x-2}{0}\Big)$	

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Scan image
johnston-linear-matrix-algebra_EQ1276 (now)	427	—	\begin{array}{r} x^2+3x+1\\ \ 3x^2-5x-2\overline{)3x^4+4x^3-14x^2-11x-2}\\ \underline{3x^4-5x^3-2x^2}\\ 9x^3-12x^2-11x-2\\ \underline{9x^3-15x^2-6x}\\ 3x^2-5x-2\\ \underline{3x^2-5x-2}\\ 0 \end{array}	$$\begin{array}{r} x^2+3x+1\\ \ 3x^2-5x-2\overline{)3x^4+4x^3-14x^2-11x-2}\\ \underline{3x^4-5x^3-2x^2}\\ 9x^3-12x^2-11x-2\\ \underline{9x^3-15x^2-6x}\\ 3x^2-5x-2\\ \underline{3x^2-5x-2}\\ 0 \end{array}$$	

basis: inferred / ink

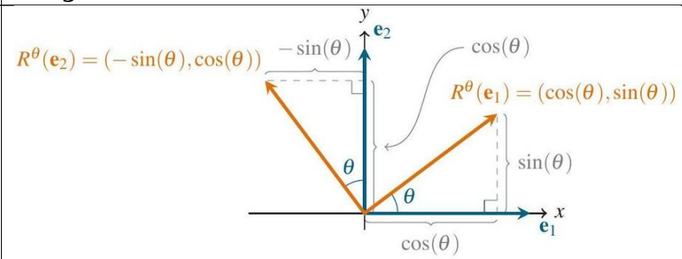
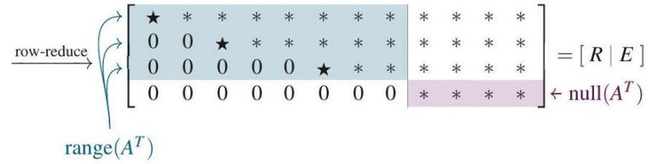
Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Unresolved

Identifier	Page	Conf.	LaTeX source	Rendered	Image
johnston-linear-matrix-algebra_ EQ0114 **[conf 0.025]**	63	■ 0.025 ●	\begin{figure} \[R^{\theta}\left(\mathbf{e}_{2} \right)=(-\sin (\theta), \cos (\theta)) \overbrace{ \cos (\theta)}^{-\sin (\theta)} \overbrace{ \mathbf{e}_{1}}^{\mathbf{e}_{2}} x \text { - } \underbrace{\cos (\theta)}_{R^{\theta}\left(\mathbf{e}_{1}\right)}=(\cos (\theta), \sin (\theta)) \] \captionsetup{labelformat=empty} \caption{Figure 1.19: \(R^{\theta}\) rotates the standard basis vectors \(\mathbf{e}_{1}\) and \(\mathbf{e}_{2}\) to \(R^{ \theta}\left(\mathbf{e}_{1}\right)=(\cos (\theta), \sin (\theta))\) and \(R^{\theta}\left(\mathbf{e}_{2} \right)=(-\sin (\theta), \cos (\theta))\), respectively.} \end{figure}	*(not rendered)*	
johnston-linear-matrix-algebra_ EQ0439	170	■ 0.131 ●	\begin{figure} \[\begin{aligned} {[A \mid I] } & =\left[\begin{array}{cccccccc|cccc} * & * & * & * & * & * & * & * & 1 & 0 & 0 & 0 \\ * & * & * & * & * & * & * & * & 0 & 1 & 0 & 0 \\ * & * & * & * & * & * & * & * & 0 & 0 & 1 & 0 \\ * & * & * & * & * & * & * & * & 0 & 0 & 0 & 1 \end{array}\right] \\ \xrightarrow{\text { row-reduce }} & (t)\left[\begin{array}{llllllll|llll} \star & * & * & * & * & * & * & * & * & * & * & * \\ 0 & 0 & \star & * & * & * & * & * & * & * & * & * \\ 0 & 0 & 0 & 0 & 0 & \star & * & * & * & * & * & * \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & * & * & * & * \end{array}\right]=[R \mid E] \leftarrow \operatorname{null}\left(A^{T}\right) \\ & \operatorname{range}\left(A^{T}\right) \end{aligned} \] \captionsetup{labelformat=empty} \caption{Figure 2.22: After we row-reduce \([A \mid I]\) to a row echelon form \([R \mid E]\), we can immediately read off bases of \(\operatorname{range}\left(A^{T}\right)\) and \(\operatorname{null}\left(A^{T}\right)\) from the rows of that matrix.} \end{figure}	*(not rendered)*	

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Image
johnston-linear-matrix-algebra-EQ0575	224	■ 0.324 ● C|+93	\begin{figure} \[\left.A=\left[\begin{array}{llllll} * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \end{array}\right]=\left[\begin{array}{lll} * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \end{array}\right] \left[\begin{array}{cccccc} * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \end{array}\right]\right\} \] \captionsetup{labelformat=empty} \caption{Figure 2.39: Theorem 2.C. 1 says that every matrix can be written as a product of a tall and skinny matrix and a short and fat matrix. The rank determines exactly how skinny and short the matrices in the product can be (as shown here, \(A\) has rank 3, so it can be written as a product of a matrix \(C\) with 3 columns and a matrix \(R\) with 3 rows).} \end{figure}	*(not rendered)*	$A = \begin{bmatrix} * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \end{bmatrix} = \begin{bmatrix} * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \\ * & * & * \end{bmatrix} \begin{bmatrix} * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \end{bmatrix}$ $\operatorname{rank}(A) = 3$

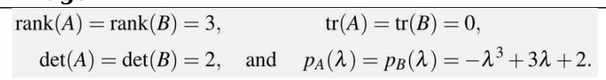
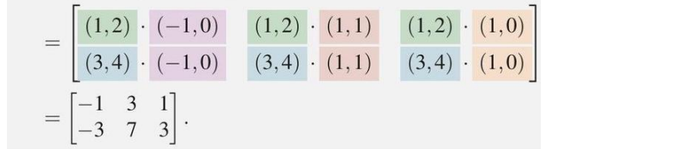
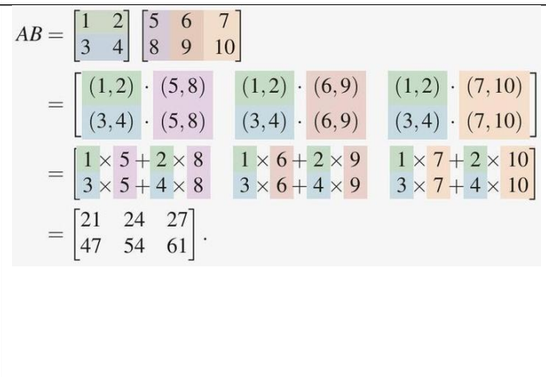
Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Flagged, not acted on

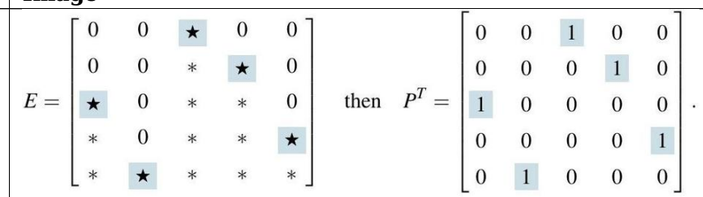
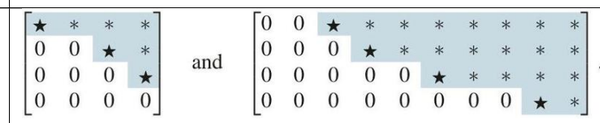
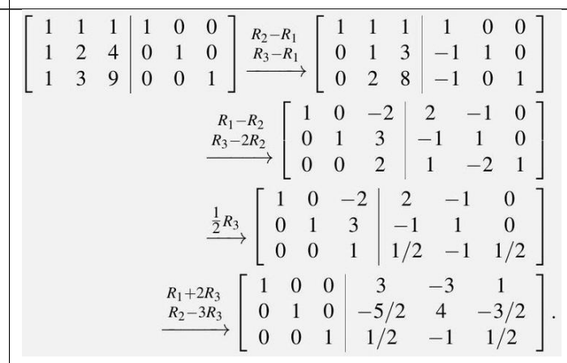
Identifier	Page	Conf.	LaTeX source	Rendered	Image
johnston-linear-matrix-algebra_ EQ0884	318	■ 0.451 ● C|+38	`\begin{aligned} \operatorname{rank}(A)= \operatorname{rank}(B) & =3, & \operatorname{tr}(A) & =\operatorname{tr}(B) \end{aligned}=0, . . .`	$\operatorname{rank}(A)=\operatorname{rank}(B)=3, \quad \operatorname{tr}(A)=\operatorname{tr}(B) \quad =0, \ldots$	
johnston-linear-matrix-algebra_ EQ0793	293	■ 0.462 ● C|+130	`\left[\begin{array}{cccc} a_{1,1} & a_{1,2} & \cdots & a_{1, n} \\ 0 & a_{2,2} & \cdots & a_{2, n} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n, 2} & \cdots & a_{n, n} \end{array}\right] \quad \text { has row echelon form }\left[\begin{array}{c|ccc} a_{1,1} & a_{1,2} & \cdots & a_{1, n} \\ \hline 0 & & & \\ \vdots & & R & \\ 0 & & & \end{array}\right],`	$\left[\begin{array}{cccc} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ 0 & a_{2,2} & \cdots & a_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & a_{n,2} & \cdots & a_{n,n} \end{array}\right]$ has row echelon form $\left[\begin{array}{c\|ccc} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ \hline 0 & & & \\ \vdots & & R & \\ 0 & & & \end{array}\right],$	
johnston-linear-matrix-algebra_ EQ0040	39	■ 0.479 ● C|+817	`\begin{aligned} A B & =\left[\begin{array}{ll} 1 & 2 \\ 3 & 4 \end{array}\right]\left[\begin{array}{lll} 5 & 6 & 7 \\ 8 & 9 & 10 \end{array}\right] \\ & =\left[\begin{array}{ccc} (1,2) \cdot(5,8) & (1,2) \cdot(6,9) & (1,2) \cdot(7,10) \\ (3,4) \cdot(5,8) & (3,4) \cdot(6,9) & (3,4) \cdot(7,10) \end{array}\right] \\ & =\left[\begin{array}{lll} 1 \times 5+2 \times 8 & 1 \times 6+2 \times 9 & 1 \times 7+2 \times 10 \\ 3 \times 5+4 \times 8 & 3 \times 6+4 \times 9 & 3 \times 7+4 \times 10 \end{array}\right] \\ & =\left[\begin{array}{lll} 21 & 24 & 27 \\ 47 & 54 & 61 \end{array}\right] . \end{aligned}`	$AB=\left[\begin{array}{ll} 1 & 2 \\ 3 & 4 \end{array}\right]\left[\begin{array}{lll} 5 & 6 & 7 \\ 8 & 9 & 10 \end{array}\right]$ $=\left[\begin{array}{ccc} (1,2)\cdot(5,8) & (1,2)\cdot(6,9) & (1,2)\cdot(7,10) \\ (3,4)\cdot(5,8) & (3,4)\cdot(6,9) & (3,4)\cdot(7,10) \end{array}\right]$ $=\left[\begin{array}{lll} 1\times 5+2\times 8 & 1\times 6+2\times 9 & 1\times 7+2\times 10 \\ 3\times 5+4\times 8 & 3\times 6+4\times 9 & 3\times 7+4\times 10 \end{array}\right]$ $=\left[\begin{array}{lll} 21 & 24 & 27 \\ 47 & 54 & 61 \end{array}\right].$	
johnston-linear-matrix-algebra_ EQ0073	48	■ 0.493 ● C|+396	`\begin{aligned} A B & =\left[\begin{array}{ll} 1 & 2 \\ 3 & 4 \end{array}\right]\left[\begin{array}{ccc} -1 & 1 & 1 \\ 0 & 1 & 0 \end{array}\right] \\ & =\left[\begin{array}{ccc} (1,2) \cdot(-1,0) & (1,2) \cdot(1,1) & (1,2) \cdot(1,0) \\ (3,4) \cdot(-1,0) & (3,4) \cdot(1,1) & (3,4) \cdot(1,0) \end{array}\right] \\ & =\left[\begin{array}{ccc} -1 & 3 & 1 \\ -3 & 7 & 3 \end{array}\right] . \end{aligned}`	$AB=\left[\begin{array}{ll} 1 & 2 \\ 3 & 4 \end{array}\right]\left[\begin{array}{ccc} -1 & 1 & 1 \\ 0 & 1 & 0 \end{array}\right]$ $=\left[\begin{array}{ccc} (1,2)\cdot(-1,0) & (1,2)\cdot(1,1) & (1,2)\cdot(1,0) \\ (3,4)\cdot(-1,0) & (3,4)\cdot(1,1) & (3,4)\cdot(1,0) \end{array}\right]$ $=\left[\begin{array}{ccc} -1 & 3 & 1 \\ -3 & 7 & 3 \end{array}\right].$	

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.

Identifier	Page	Conf.	LaTeX source	Rendered	Image
johnston-linear-matrix-algebra_EQ0635 (O)	243	■ 0.508 ● C|+27	`E=\left[\begin{array}{ccccc} 0 & 0 & \star & 0 & 0 \\ 0 & 0 & * & \star & 0 \\ \star & 0 & * & * & 0 \\ * & 0 & * & * & \star \\ * & \star & * & * & * \end{array}\right] \text { then } P^{T}=\left[\begin{array}{ccccc} 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{array}\right] .`	$E=\begin{bmatrix} 0 & 0 & \star & 0 & 0 \\ 0 & 0 & * & \star & 0 \\ \star & 0 & * & * & 0 \\ * & 0 & * & * & \star \\ * & \star & * & * & * \end{bmatrix} \text{ then } P^{T}=\begin{bmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix} .$	
johnston-linear-matrix-algebra_EQ0214	101	■ 0.533 ● C|+146	`\left[\begin{array}{llll} \star & * & * & * \\ 0 & 0 & \star & * \\ 0 & 0 & 0 & \star \\ 0 & 0 & 0 & 0 \end{array}\right] \quad \text { and } \quad\left[\begin{array}{lllllllll} 0 & 0 & \star & * & * & * & * & * & * \\ 0 & 0 & 0 & \star & * & * & * & * & * \\ 0 & 0 & 0 & 0 & 0 & \star & * & * & * \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \star & * \end{array}\right] .`	$\begin{bmatrix} \star & * & * & * \\ 0 & 0 & \star & * \\ 0 & 0 & 0 & \star \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} 0 & 0 & \star & * & * & * & * & * & * \\ 0 & 0 & 0 & \star & * & * & * & * & * \\ 0 & 0 & 0 & 0 & 0 & \star & * & * & * \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \star & * \end{bmatrix} .$	
johnston-linear-matrix-algebra_EQ0331 (O)	130	■ 0.564 ● C|+20	`\begin{array}{r} {\left[\begin{array}{lll|lll} 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 2 & 4 & 0 & 1 & 0 \\ 1 & 3 & 9 & 0 & 0 & 1 \end{array}\right] \xrightarrow{\substack{R_{2}-R_{1} \\ R_{3}-R_{1}}}\left[\begin{array}{lll|lll} 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 2 & 8 & -1 & 0 & 1 \end{array}\right]} \\ \xrightarrow{R_{1}-R_{2}}\left[\begin{array}{lll|lll} 1 & 0 & -2 & 2 & -1 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 0 & 2 & 1 & -2 & 1 \end{array}\right] \\ \xrightarrow{\frac{1}{2} R_{3}}\left[\begin{array}{lll|lll} 1 & 0 & -2 & 2 & -1 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 0 & 1 & 1 / 2 & -1 & 1 / 2 \end{array}\right] \\ \xrightarrow{R_{1}+2 R_{3}}\left[\begin{array}{lll|lll} 1 & 0 & 0 & 3 & -3 & 1 \\ 0 & 1 & 0 & -5 / 2 & 4 & -3 / 2 \\ 0 & 0 & 1 & 1 / 2 & -1 & 1 / 2 \end{array}\right] \end{array}`	$\left[\begin{array}{lll\|lll} 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 2 & 4 & 0 & 1 & 0 \\ 1 & 3 & 9 & 0 & 0 & 1 \end{array}\right] \xrightarrow{\substack{R_2-R_1 \\ R_3-R_1}} \left[\begin{array}{lll\|lll} 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 2 & 8 & -1 & 0 & 1 \end{array}\right]$ $\xrightarrow{R_1-R_2} \left[\begin{array}{lll\|lll} 1 & 0 & -2 & 2 & -1 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 0 & 2 & 1 & -2 & 1 \end{array}\right]$ $\xrightarrow{\frac{1}{2}R_3} \left[\begin{array}{lll\|lll} 1 & 0 & -2 & 2 & -1 & 0 \\ 0 & 1 & 3 & -1 & 1 & 0 \\ 0 & 0 & 1 & 1/2 & -1 & 1/2 \end{array}\right]$ $\xrightarrow{R_1+2R_3} \left[\begin{array}{lll\|lll} 1 & 0 & 0 & 3 & -3 & 1 \\ 0 & 1 & 0 & -5/2 & 4 & -3/2 \\ 0 & 0 & 1 & 1/2 & -1 & 1/2 \end{array}\right] .$	

Conf. MathPix confidence: ■ ≥0.9 ■ 0.5–0.9 ■ <0.5 — no value

LaTeX source MathPix's reading, unchanged; **Rendered** the same reading, with a display environment (align/alignat/flalign/eqnarray/gather/multline/split) mapped to its in-math form so it can typeset in this cell — the two may legitimately differ

Residual render vs scan (inkdrill): ● C component ● W weak ● S stable ● N noise ● K clean ● not measured

[refined: *basis*] beside an identifier: the LaTeX-source and Rendered cells both show a VERIFIED refinement, not MathPix's own reading — *basis* names what verified it (e.g. ink, source). The original reading is unchanged in the model but is not the one drawn here.