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50/50

— M436 — Midterm —

The following 5 problems are multiple choice. Each correct answer is worth 10 points. An incorrect answer results in a 5 point penalty, and no answer is worth 0 points. All problems take place in the real projective plane $\mathbf{RP}^2$. Only one checkmark per problem is allowed. Multiple checkmarks or other ambiguous notation results in 0 points. Shown work will be disregarded.

No notes or electronic devices are allowed at any time. The presence of any of these is considered as cheating and will be treated as such.

1. The line through the points $(1:-2:2)$ and $(1:2:-3)$ is incident with the point

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- ☐ $(-1:2:0)$
- ☒ $(-2:0:1)$
- ☐ $(0:2:-1)$
- ☐ none of these.

2. The lines $x-2y-3z=0$ and $3x+3z=0$ are concurrent with the line

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- ☐ $y-z=0$
- ☐ $x-z=0$
- ☒ $x+z=0$
- ☐ none of these.

3. The conic $x^2+2xz-2yz-z^2=0$ has

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- ☒ $2x-y-z=0$
- ☐ $x-2y+z=0$
- ☐ $2x+y-z=0$
- ☐ none of these

as a tangent line.

4. The projective linear transformation given by

$$A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

maps the line $x + y + z = 0$ to the line

- ☐ $y + z = 0$
- ☐ $2x + y + z = 0$
- ■ $x + y = 0$
- ☐ none of these.

5. Let T be the projective linear transformation that maps $(1:1:1)$ to $(0:1:1)$ to $(1:0:1)$ to $(1:1:0)$ to $(1:1:1)$. Then T maps $(1:0:0)$ to

- ■ $(2:1:3)$
- ☐ $(2:3:1)$
- ☐ $(4:3:3)$
- ☐ none of these.