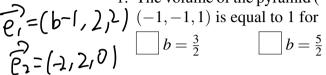
Name: \_\_

Student No.: \_\_\_\_

Group A

For each of the following problems, find the correct answer (tick as appropriate!). No justifications are required. Each problem has exactly one correct solution, which is worth 1 mark. Incorrect solutions (including no answer, multiple answers, or unreadable answers) will be assigned 0 marks; there are no penalties.

1. The volume of the pyramid ("tetrahedron") with vertices (b, 1, 1), (1, -1, -1), (-1, 1, -1),







 $\begin{vmatrix}
b-1 & -2 & -2 \\
2 & 2 & 0 \\
5 & 0 & 2
\end{vmatrix}$ The inverse matrix of  $\begin{pmatrix}
2 & 3 & 5 \\
1 & 2 & 3 \\
0 & 1 & 2
\end{pmatrix}$ has the form  $\begin{pmatrix}
* & * & * \\
* & c & * \\
* & * & *
\end{cases}$ 



[(4(b-1)-



4. The reflection of  $\mathbb{R}^2$  at the line  $\sqrt{3}x + y = 0$  is afforded by the matrix

/, 5. The maximum rank of  $\mathbf{A} \in \mathbb{R}^{3\times 4}$  with all row sums and all columns sums equal to zero is

6. The linear system  $2x_1 - x_2 = x_1 + ax_2 + x_3 = x_1 - x_2 + 2x_3 = 0$  has a nonzero solution for  $a = -\frac{1}{4}$   $a = -\frac{3}{4}$   $a = \frac{3}{4}$   $a = -\frac{5}{4}$ 

7. If  $f: [0,\pi] \to \mathbb{R}^3$  satisfies f(0) = (0,0,1) and  $f'(t) = (2t,\sin t,\cos t)$  then the point  $f(\pi)$  is equal to

 $(\pi^2, -2, 1)$   $(\pi^2, 2, 1)$   $(\pi^2, 2, 0)$   $(\pi^2, -2, 0)$ 

8. The twisted cubic  $f(t) = (t, t^2/t^3), t \in \mathbb{R}$  intersects the plane 3x - y + 2z = 4 in an angle of

0°

90°

9. The arc length of the curve  $g(t) = (t^3 + 3t + 1, \sqrt{3}t^2, 4t - 2), \ t \in [0, 2]$  is



10. For a differentiable curve  $\gamma = \gamma(t)$  in  $\mathbb{R}^3$  and a (constant) vector  $\mathbf{u} \in \mathbb{R}^3$  with  $|\mathbf{u}| = 1$  the derivative  $\frac{d}{dt} |\gamma - (\gamma \cdot \mathbf{u})\mathbf{u}|^2$  is equal to

 $2|\mathbf{\gamma} - (\mathbf{\gamma} \cdot \mathbf{u})\mathbf{u}|$ 

 $\sum_{\mathbf{u}} 2 |\mathbf{y} - (\mathbf{y} \cdot \mathbf{u})\mathbf{u}| (\mathbf{y} - (\mathbf{y} \cdot \mathbf{u})\mathbf{u})$ 

Time allowed: 40 min

**CLOSED BOOK** 

Good luck!

 $(r_1 - (r \cdot u)u_1)^2 + (r_2 - (r \cdot u)u_2)^2 + (r_3 - r \cdot u)u_3)^2$   $2 (r_1 - (r \cdot u)u_1) \cdot (r_1' - (r' \cdot u)u_1) +$