

PART A (18 marks)

NOTE: YOUR ANSWERS TO THE PROBLEMS IN PART A MUST BE INDICATED ON THE SCANTRON SHEET. YOU SHOULD ALSO CIRCLE YOUR ANSWERS IN THIS BOOKLET.

1
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1. Let $\mathbf{u} = (1, -1, 2, 3)$ and $\mathbf{v} = (0, 2, -1, 2)$ be vectors in \mathbb{R}^4 . Find the vector $2\mathbf{u} - 3\mathbf{v}$.

A: $(2, -2, 4, 6)$	B: $(0, -6, 3, -6)$	C: $(1, -3, 3, 1)$	D: $(2, 4, 1, 12)$	E: $(2, -8, 7, 0)$
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2. If $\mathbf{u} = (1, 2, 3)$ and $\mathbf{v} = (0, 1, 1)$, find $d(\mathbf{u}, \mathbf{v})$, the distance between vector \mathbf{u} and vector \mathbf{v} .

A: $\sqrt{14}$	B: $-\sqrt{14}$	C: 4	D: $\sqrt{6}$	E: $-\sqrt{6}$
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3. Which one of the following is a unit vector in the opposite direction to $\mathbf{u} = (2, -1, 2)$?

A: $\left(\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}\right)$	B: $\left(-\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}\right)$	C: $\left(-\frac{2}{\sqrt{7}}, \frac{1}{\sqrt{7}}, -\frac{2}{\sqrt{7}}\right)$
D: $\left(\frac{2}{\sqrt{7}}, -\frac{1}{\sqrt{7}}, \frac{2}{\sqrt{7}}\right)$	E: $\left(\frac{2}{9}, -\frac{1}{9}, \frac{2}{9}\right)$	

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4. Find the value of k for which the vectors $\mathbf{u} = (2, k, -1)$ and $\mathbf{v} = (-6, 12, 3)$ are collinear.

A: -4	B: 4	C: $-\frac{5}{4}$	D: $\frac{5}{4}$	E: $\frac{1}{4}$
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mark

5. Let $\mathbf{u} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\mathbf{v} = -2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k}$. Find $\mathbf{u} \cdot \mathbf{v}$.

A: -4	B: 19	C: -6	D: -13	E: 8
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6. For what value of k are the vectors $\mathbf{u} = (2, -3, -2, k)$ and $\mathbf{v} = (-2, 3, 2, 1)$ orthogonal?

A: 17	B: -17	C: 1	D: -1	E: 0
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mark

7. If θ is the angle between the vectors $\mathbf{u} = (0, 1, 2)$ and $\mathbf{v} = (1, 1, -1)$, what is the value of $\cos \theta$?

A: $\frac{1}{15}$	B: $-\frac{1}{15}$	C: $-\frac{1}{\sqrt{15}}$	D: $\frac{1}{\sqrt{15}}$	E: 0
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mark

8. Find the area of the parallelogram determined by vectors $\mathbf{u} = (0, 1, -1)$ and $\mathbf{v} = (1, 2, 3)$.

A: $\sqrt{28}$	B: $\sqrt{27}$	C: $\sqrt{23}$	D: 27	E: 1
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mark

9. Which one of the following vectors is orthogonal to both of the vectors $\mathbf{u} = (0, 1, -1)$ and $\mathbf{v} = (1, 2, 3)$ (the vectors from question 8)?

A: $(5, -1, 1)$	B: $(0, 1, 1)$	C: $(3, 2, -1)$	D: $(0, 3, -2)$	E: $(5, -1, -1)$
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mark

10. Which of the following is/are **true** for all vectors \mathbf{u} and \mathbf{v} in \mathbb{R}^3 ?

- (i) $\mathbf{u} \cdot \mathbf{v} = \mathbf{v} \cdot \mathbf{u}$

(ii) $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$

(iii) $\mathbf{u} \times \mathbf{u} = (0, 0, 0)$

A: (i) only	B: (ii) only	C: (i) and (ii) only
D: (i) and (iii) only	E: all of (i), (ii) and (iii)	

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mark

11. Which of the following is a standard form equation for the plane through point $P(3, 4, 1)$ with normal vector $\mathbf{n} = (-2, 3, 6)$?

A: $-2x + 3y + 6z = 12$	B: $-2x + 3y + 6z = 0$	C: $3x + 4y + z = 0$
D: $3x + 4y + z = 12$	E: $3x + 4y + z = 6$	

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mark

12. Which one of the following vectors is parallel to the plane $2x - 5y - z = 3$?

A: $(2, -5, -1)$	B: $(3, 1, 1)$	C: $(1, 2, 5)$	D: $(3, 1, -2)$	E: $(5, 2, -1)$
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- 1 mark* 13. Which one of the following is a point-parallel form equation of the line through the points $P(1, 2, 0, 4)$ and $Q(-1, 3, 1, 2)$?

A: $(x_1, x_2, x_3, x_4) = (-2, 1, 1, -2) + t(-1, 3, 1, 2)$
B: $(x_1, x_2, x_3, x_4) = (0, 0, 0, 0) + t(-2, 1, 1, -2)$
C: $(x_1, x_2, x_3, x_4) = (1, 2, 0, 4) + t(-2, 1, 1, -2)$
D: $(x_1, x_2, x_3, x_4) = (1, 2, 0, 4) + t(-1, 3, 1, 2)$
E: $(x_1, x_2, x_3, x_4) = (-1, 3, 1, 2) + t(1, 2, 0, 4)$

- 1 mark* 14. If $P(a, b, c)$ is the point of intersection of the line $\mathbf{x}(t) = (3, 0, -7) + t(2, -2, 5)$ with the plane $x + 2y + z = 2$, find c .

A: 2	B: -4	C: 3	D: 7	E: 0
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- 1 mark* 15. For what value of k does the point $(1, 9, k)$ lie on the line $(x, y, z) = (1, 3, -2) + t(0, 2, 4)$?

A: 10	B: -2	C: -6	D: 5	E: 18
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- 1 mark* 16. Which one of the following is a standard form equation of the line through the point $(1, 5)$ which is parallel to the vector $\mathbf{u} = (-1, 3)$?

A: $3x + y = 8$	B: $3x + y = 0$	C: $-x + 3y = 0$	D: $-x + 3y = 16$	E: $5x - y = -8$
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- 1 mark* 17. Which one of the following lines in \mathbb{R}^2 is perpendicular to the line $2x - y = 3$?

A: $x - 2y = 3$	B: $2x - y = 5$	C: $2x - y = \frac{3}{2}$
D: $(x, y) = (0, 2) + t(2, -1)$	E: $(x, y) = (-5, 1) + t(1, 2)$	

- 1 mark* 18. Find the distance between the point $A(2, -5, 0)$ and the plane $2x + 2y - 3z = -1$.

A: $-\frac{5}{\sqrt{17}}$	B: $\frac{6}{\sqrt{17}}$	C: $-\frac{6}{\sqrt{17}}$	D: $\frac{5}{\sqrt{18}}$	E: $\frac{5}{\sqrt{17}}$
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PART B (7 marks)

YOU MUST SHOW YOUR WORK FOR ALL QUESTIONS IN PART B.

- 2 marks* 19. Let $\mathbf{u} = (1, 2, -2)$, $\mathbf{v} = (3, 0, 1)$ and $\mathbf{w} = (2, 2, -1)$.
(a) Find $\mathbf{u} \times \mathbf{v}$.

- (b) Find the volume of the parallelepiped determined by the vectors \mathbf{u} , \mathbf{v} and \mathbf{w} .

- 2 marks* 20. Find the point of intersection of the lines ℓ_1 and ℓ_2 , which have parametric equations shown here:

$$\begin{array}{ll} \ell_1 : & x = t \\ & y = 2 - 3t \\ & z = 2 + t \end{array} \qquad \begin{array}{ll} \ell_2 : & x = 4 + 3r \\ & y = -3 - 2r \\ & z = 2 - r \end{array}$$

*3
marks*

21. Consider the points $P(-2, 3, 1)$ and $Q(1, 4, 3)$ in \mathbb{R}^3 .

(a) Write parametric equations of the line through P and Q .

(b) Write a standard form equation of the plane through point P which is perpendicular to the line through P and Q (i.e. the line in part (a)).

Instructor's Name (**Print**)

Student's Name (**Print**)

Student's Signature

THE UNIVERSITY OF WESTERN ONTARIO
LONDON CANADA
DEPARTMENT OF MATHEMATICS
Mathematics 1229A Test 1

Friday, October 20, 2017

Code 111

7:00 p.m. - 8:30 p.m.

INSTRUCTIONS

1. Fill in the tops of this page **and the back of this page** completely. Be sure to print your name **legibly**.
2. Fill in the top of the scantron card completely. **Both print AND code** your Student Number, Section Number (see below) and Exam Code (shown above).
3. CALCULATORS AND NOTES ARE NOT PERMITTED.
4. DO NOT UNSTAPLE THE BOOKLET.
5. There are two parts to this examination: PART A (18 marks) in multiple choice format and PART B (7 marks) in written answer format.
6. In Part A, **circle** the correct answer to each question **on this paper** AND fill in the appropriate box on the **scantron** card with an HB pencil. This question paper will be returned to you.
7. In Part B, write your answer in the space provided.
8. Questions are printed on both sides of the paper. They begin on Page 1 and continue to Page 5. Be sure that your booklet is complete.
9. You must hand in this question paper, your scantron card, and all rough work sheets.
10. Circle your section in the list below.

Instructor	Campus/College	Time	Section
Ghorbanpour	Main	9:30 MWF	001
Moschandreou	Main	12:30 MWF	002
Olds	Main	1:30 MWF	003
Zsamboki	Main	8:30 MWF	004
Florence	Brescia	8:30 MTuTh	530
Florence	Brescia	9:30 MTuW	531
Rastegari	Huron	8:30 MWF	550
Mollahajiaghaei	Huron	11:30 MWF	551
Meredith	King's	9:30 TuTh	570
Meredith	King's	1:30 TuTh	571
Meredith	King's	1:30 MW	572
Kuzmin	King's	7:00 MW	573

11. TOTAL MARKS = 25.

Student Number (**Print**)

Student's Name (**Print**)

FOR GRADING ONLY

PAGE	MARK
1–3	
4	
5	
TOTAL	