



UNIVERSITY OF JOHANNESBURG

Applied Mathematics 1A10

TEST 1

17 March 2016

TIME: 90 min

MARKS: 40

INSTRUCTIONS:

- Write your student number and phone number.
- Start with any question. Each subsequent question must start on a new page.
- Do all four questions.
- Use proper notations e.g. **bars** for vectors, and no bars for their magnitudes.
- Show **arrow-heads** in line segments, for vectors such as \bar{a}, \bar{b} , etc.
- Calculators may be used for the **final answer** only. In such a case, the answer must be correct to **two** decimal places.
- Do not forget the **lecture** today at 16:20.

Figure 1

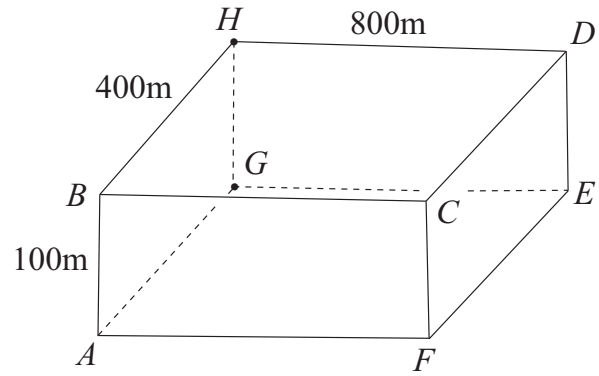


Figure 2

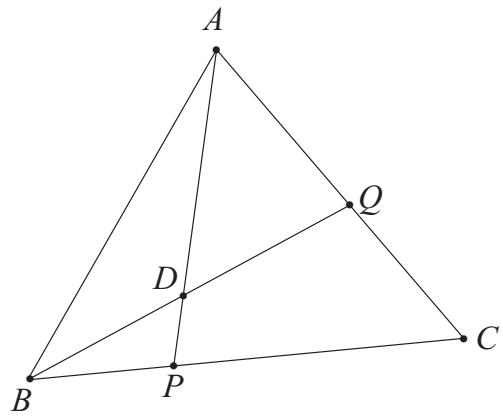
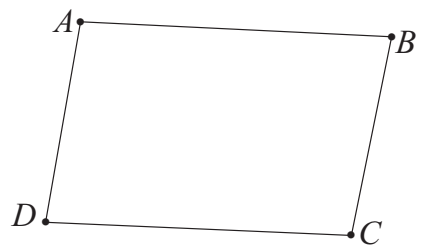


Figure 3



Question 1

A helicopter flies 100m vertically upwards from A to B , then 800m horizontally North to C and then 400m horizontally West to D . Calculate:

(1.1) $\angle ADC$. (3)

(1.2) the direction of \overline{AD} , in degrees North of West. (3)

(1.3) the angle of elevation of \overline{AD} . (4)

[You may use figure 1 of the 2nd page.] [10]

Question 2

In figure 2, 2nd page, $AQ : QC = CP : PB = 2 : 1$. Suppose $\bar{a} = \overline{QC}$ and $\bar{b} = \overline{PB}$.

(2.1) Express \overline{AB} and \overline{AP} i.t.o. \bar{a} and \bar{b} . (3)

(2.2) Find k such that $\overline{AD} = k\overline{AP}$. (7)

[10]

Question 3

Consider the parallelogram $ABCD$ (figure 3) where $A = (5, -2, 6)$, $B = (7, -6, 10)$ and $C = (9, -7, 8)$.

(3.1) Express \overline{BD} i.t.o. \hat{x} , \hat{y} and \hat{z} . (2)

(3.2) Use the dot product to show that one of the interior angles of $ABCD$ is 90° . (2)

(3.3) Calculate $\angle CBD$ using the dot product. (4)

(3.4) Find the position vector of D . (2)

[10]

Question 4

(4.1) Suppose $a = 3$, $b = 2$ and the angle between \bar{a} and \bar{b} is 60° .
Calculate the magnitude of $2\bar{a} + 3\bar{b}$. (4)

(4.2) Calculate the (shortest) distance of $P(9, -10, 5)$ from the line which passes through $A(1, 0, 1)$ and $B(2, -2, 3)$. (6)

[10]

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UNIVERSITY OF JOHANNESBURG
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TEST 2

24 APRIL 2014

Surname & Initials:

Student number:

Signature:

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