

**Mathematics**  
**Standard level**  
**Paper 2**

Thursday 3 May 2018 (morning)

1 hour 30 minutes

Candidate session number

--	--	--	--	--	--	--	--	--	--

**Instructions to candidates**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[90 marks]**.

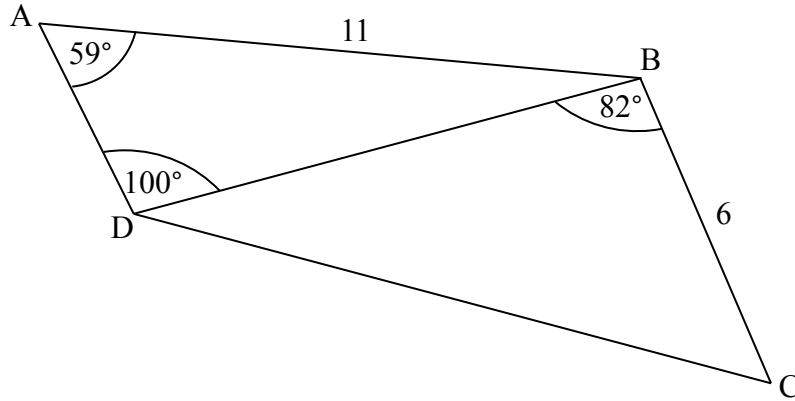




2. [Maximum mark: 6]

The following diagram shows quadrilateral ABCD.

diagram not to scale



$AB = 11 \text{ cm}$ ,  $BC = 6 \text{ cm}$ ,  $\hat{B}AD = 59^\circ$ ,  $\hat{A}DB = 100^\circ$ , and  $\hat{C}BD = 82^\circ$

(a) Find DB. [3]

(b) Find DC. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

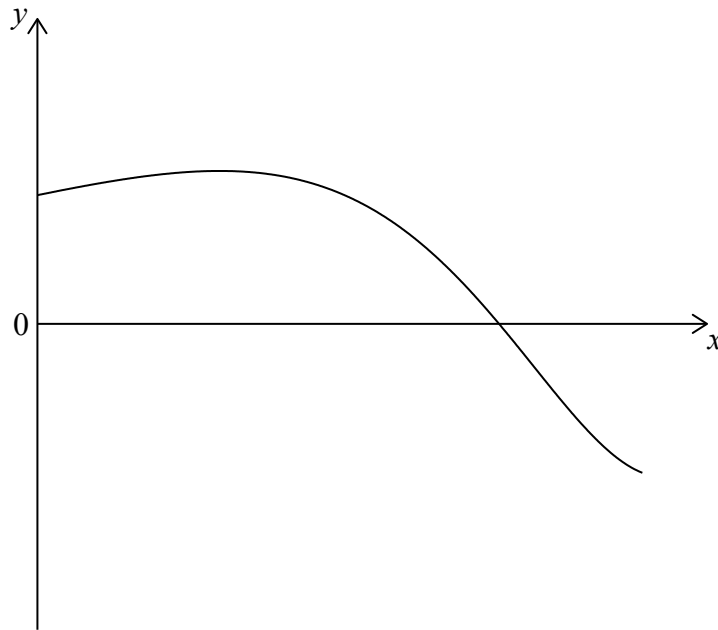
.....

.....



3. [Maximum mark: 5]

Let  $f(x) = \sin(e^x)$  for  $0 \leq x \leq 1.5$ . The following diagram shows the graph of  $f$ .



(a) Find the  $x$ -intercept of the graph of  $f$ . [2]

(b) The region enclosed by the graph of  $f$ , the  $y$ -axis and the  $x$ -axis is rotated  $360^\circ$  about the  $x$ -axis.

Find the volume of the solid formed. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





Please **do not** write on this page.

Answers written on this page  
will not be marked.

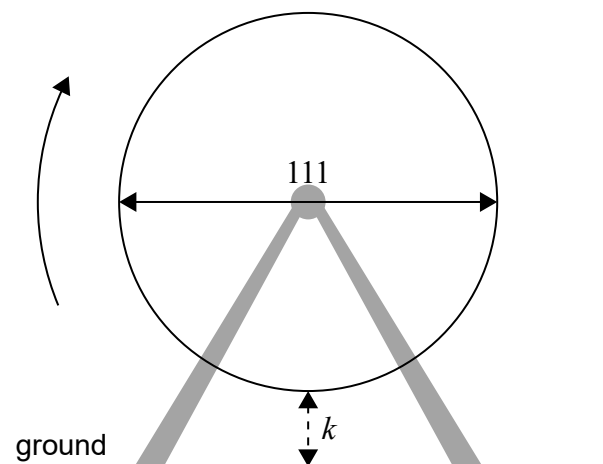




6. [Maximum mark: 8]

At an amusement park, a Ferris wheel with diameter 111 metres rotates at a constant speed. The bottom of the wheel is  $k$  metres above the ground. A seat starts at the bottom of the wheel.

diagram not to scale



The wheel completes one revolution in 16 minutes.

(a) After 8 minutes, the seat is 117 m above the ground. Find  $k$ . [2]

After  $t$  minutes, the height of the seat above ground is given by  $h(t) = 61.5 + a \cos\left(\frac{\pi}{8}t\right)$ , for  $0 \leq t \leq 32$ .

(b) Find the value of  $a$ . [3]

(c) Find when the seat is 30 m above the ground for the third time. [3]

(This question continues on the following page)









Do **not** write solutions on this page.

### Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

8. [Maximum mark: 13]

Two points P and Q have coordinates (3, 2, 5) and (7, 4, 9) respectively.

(a) (i) Find  $\vec{PQ}$ .

(ii) Find  $\left| \vec{PQ} \right|$ . [4]

Let  $\vec{PR} = 6\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ .

(b) Find the angle between PQ and PR. [4]

(c) Find the area of triangle PQR. [2]

(d) Hence or otherwise find the shortest distance from R to the line through P and Q. [3]

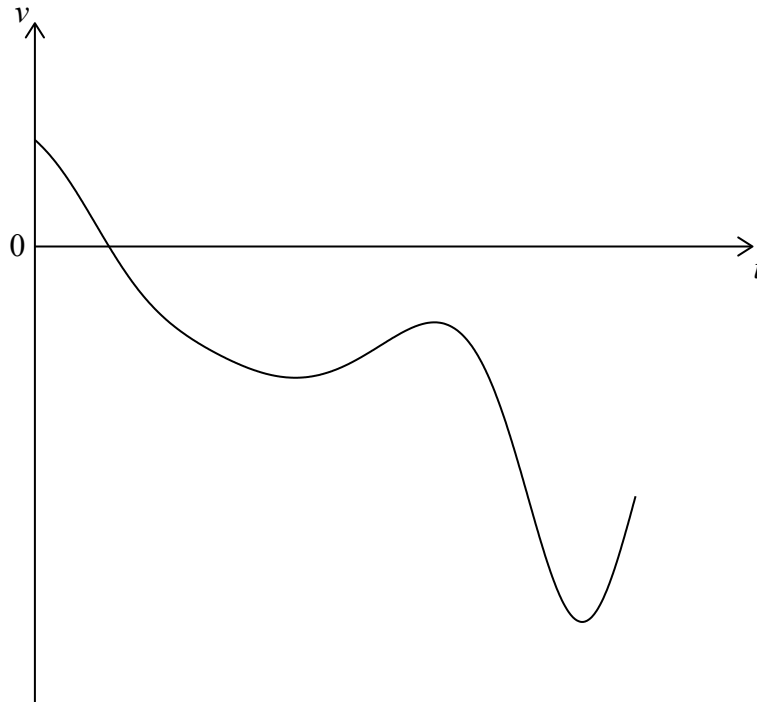


Do **not** write solutions on this page.

9. [Maximum mark: 15]

A particle P moves along a straight line. The velocity  $v \text{ m s}^{-1}$  of P after  $t$  seconds is given by  $v(t) = 7 \cos t - 5t^{\cos t}$ , for  $0 \leq t \leq 7$ .

The following diagram shows the graph of  $v$ .



- (a) Find the initial velocity of P. [2]
- (b) Find the maximum speed of P. [3]
- (c) Write down the number of times that the acceleration of P is  $0 \text{ m s}^{-2}$ . [3]
- (d) Find the acceleration of P when it changes direction. [4]
- (e) Find the total distance travelled by P. [3]



Do **not** write solutions on this page.

**10.** [Maximum mark: 17]

The mass  $M$  of apples in grams is normally distributed with mean  $\mu$ . The following table shows probabilities for values of  $M$ .

<b>Values of <math>M</math></b>	$M < 93$	$93 \leq M \leq 119$	$M > 119$
<b><math>P(X)</math></b>	$k$	0.98	0.01

- (a) (i) Write down the value of  $k$ .
- (ii) Show that  $\mu = 106$ . [4]
- (b) Find  $P(M < 95)$ . [5]

The apples are packed in bags of ten.

Any apples with a mass less than 95 g are classified as small.

- (c) Find the probability that a bag of apples selected at random contains at most one small apple. [3]
- (d) A crate contains 50 bags of apples. A crate is selected at random.
  - (i) Find the expected number of bags in this crate that contain at most one small apple.
  - (ii) Find the probability that at least 48 bags in this crate contain at most one small apple. [5]



Please **do not** write on this page.

Answers written on this page  
will not be marked.



16EP14

Please **do not** write on this page.

Answers written on this page  
will not be marked.



16EP15

Please **do not** write on this page.

Answers written on this page  
will not be marked.



16EP16