

KINROSS HIGH SCHOOL

Prelim Examination

January 2014

National 5

Lifeskills Mathematics

Paper 2

Duration: 1hour 40 minutes

Fill in these boxes and read what is printed below.

Forename(s)

Surname

Number of seat

Total marks — 55

You may use a calculator.

Attempt ALL questions.

Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.

Write your working and answers in the spaces provided. Additional blank paper and square-ruled paper is available should you require it. If you use additional paper, write your name and the number of the question clearly on it.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Before leaving the examination room you must give this booklet to the Invigilator.

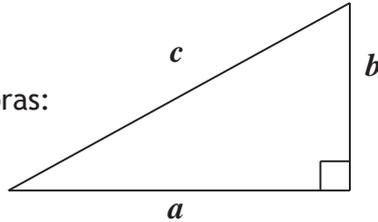
If you do not, you may lose all the marks for this paper.

FORMULAE LIST

Circumference of a circle: $C = \pi d$

Area of a circle: $A = \pi r^2$

Theorem of Pythagoras:



$$a^2 + b^2 = c^2$$

Volume of a cylinder: $V = \pi r^2 h$

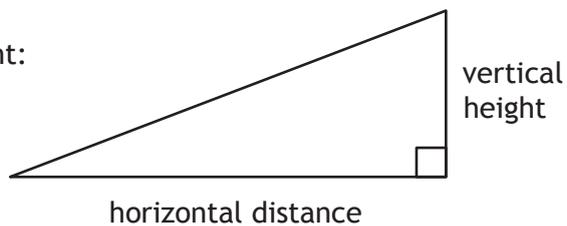
Volume of a prism: $V = Ah$

Volume of a cone: $V = \frac{1}{3} \pi r^2 h$

Volume of a sphere: $V = \frac{4}{3} \pi r^3$

Standard deviation: $s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$, where n is the sample size.

Gradient:



$$\text{gradient} = \text{vertical height} / \text{horizontal distance}$$

1. Jeff is a self-employed haulier. He has available a DAF 150 truck which has a box body. The dimensions of the box body are 3.4m by 2.2m by 2.7m.

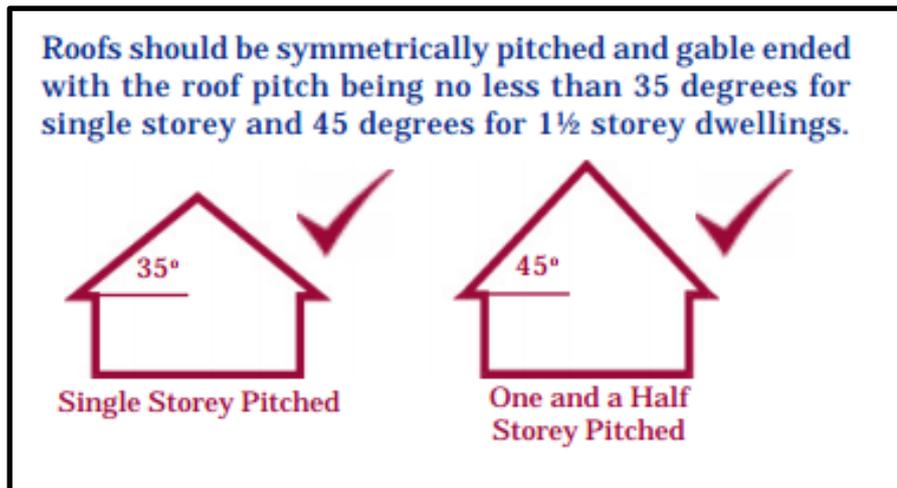
He has been asked to deliver a metal rod of length 4.6m which cannot be bent.

Can he fit the rod into the truck?

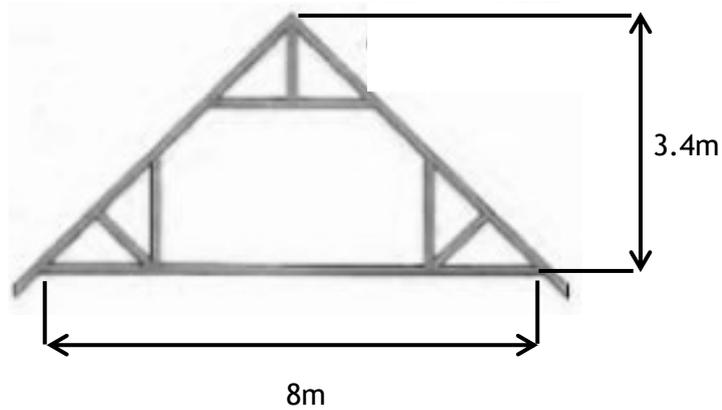
You must justify your answer.



2. David is building a single storey cottage in the countryside. The roof of his house comply with the following building regulations:



He has chosen the following symmetrical roof trusses for his house.



- (a) By making a scale drawing, using a scale of 1cm = 1m, determine whether the roof pitch will comply with building regulations.

2. (continued)

One side of the roof is ideally suited for fitting solar panels. As part of a government initiative, householders receive an income from returning surplus electricity from their solar panels to the main electricity supply.

David must decide whether he wants to fit solar panels which have a system size of 3.0kW(p) or 4.0kW(p).

The income he receives from his solar panels will consist of two parts:

- i) Income from the government for exporting electricity
- ii) Savings on his electricity bill

He considers the following information:

System Size	Annual Income from exporting electricity	Annual Electricity Savings	Installation Costs
3.0kW(p)	£394	£88	£6430
4.0kW(p)	£526	£117	£7080

(b) By calculating the length of time it will take for each system to “pay for itself,” which system should he install?

You must justify your answer.

3

(c) How many months earlier will this system “pay for itself”? Give your answer to the nearest month?

2

3. Sarah wants to buy her first car. She needs to borrow £5000 to do this. She is considering loans from the three different providers below:

Provider	Supermarket Bank		High Street Bank		Car Dealer	
APR	6.0%		11.9%		15.9%	
Repayment terms over 3 years	Monthly	Total	Monthly	Total	Monthly	Total
	£151.75	A	B	£5918.40	£172.95	£6226.20

- (a) What is the total repayment (A) on the loan from the Supermarket Bank?

1

- (b) What is the monthly repayment (B) on the loan from the High Street Bank?

1

The car dealership is offering a special incentive to customers. If they arrange their loan with them, they will pay half of each of the first six months instalments.

- (c) Given this extra information, which provider would offer Melissa the lowest total cost?

You must justify your answer.

2

3. (continued)

Sarah decided to apply for the loan with the lowest total cost. After she submitted her application she was told that her monthly payments would increase by 5% as she had only been in her current job for six months.

(d) Given this information, should Melissa change who she applies to for the loan?

You must justify your answer.

2

4. A vending machine manufacturer makes tokens for its machines. These tokens are 3.4 millimetres thick to the nearest 0.05mm.

(a) Write down the minimum and maximum acceptable thickness of a token

1

(b) There have been reports that some of the tokens have not been working properly in the machines. A sample of tokens has been taken by the manufacturer. The results are shown below.

3.41	3.40	3.46	3.39	3.36	3.42	3.45	3.52	3.37
3.38	3.39	3.43	3.41	3.44	3.48	3.35	3.38	3.42
3.44	3.51	3.34	3.38	3.42	3.43	3.42	3.40	3.46

If more than 20% are not within tolerance, the manufacturer will have to recalibrate the manufacturing process.

Will the process have to be reset?
You must justify your answer.

3

5. Melissa wants to be a greener consumer. She is considering changing energy supplier to Good Energy who generate electricity from wind, hydro and solar sources.



	Electricity		Gas	
	Standing Charge per day (pence)	Unit price per kWh (pence)	Standing Charge per day (pence)	Unit price per kWh (pence)
Good Energy	18.71	15.59	22.34	4.157
E-on	16.4	14.9	21.9	4.358

E-on offer an annual dual fuel **discount** of £20. This is applied to the total annual cost when a customer buys both electricity and gas from E-on.

The typical annual electricity and gas consumption for a UK household is 3,300kWh and 16,500kWh respectively.

- (a) If Melissa’s electricity and gas consumption is typical of a UK household, calculate how much she will pay in total for energy if she moves to Good Energy?

3

- (b) If Melissa currently buys her electricity and gas from E-on, how much will it cost her to “go green” per annum?

2

6. An online retailer has been monitoring the time taken to pick and pack orders at one of their warehouses.



The time taken to pick and pack a random sample of six orders was recorded, in minutes, as follows:

10, 5, 6, 9, 10, 11

- (a) Calculate the mean and standard deviation for this data.

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- (b) After a reorganisation of the warehouse, another random sample was taken. The mean and standard deviation for this second sample was 8 minutes and 1.55 minutes respectively.

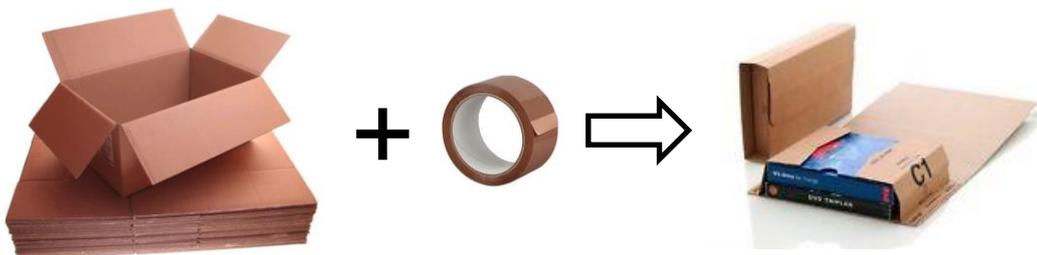
Was the warehouse reorganisation successful?

Justify your answer.

2

6. (continued)

The retailer hopes to reduce packing times further by moving from using boxes and packaging tapes to self-adhesive wraps.



The retailer estimates that by using the wraps it will take 2 minutes less to wrap each order. The wraps however are more expensive than the boxes and tape.

The cost of boxes for 100 orders is £36.20.

The cost of tape to assemble these boxes is £5.80.

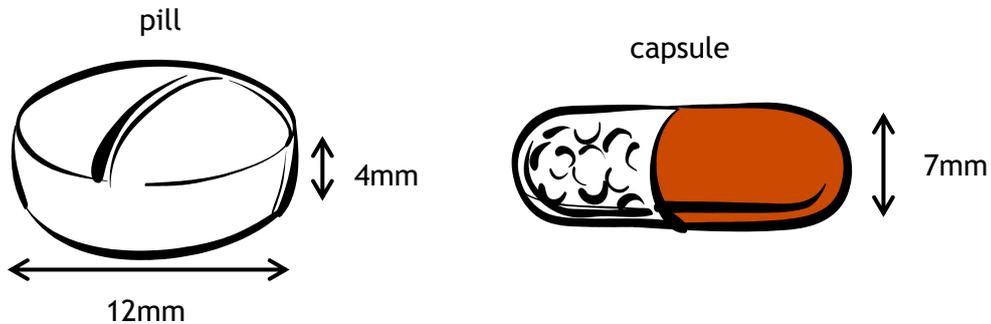
An employee at the warehouse is paid £7.95 per hour.

The cost of 100 wraps is £63.10

(c) Should the retailer switch to using the wraps?

You must justify your answer fully.

7. A pharmaceutical company wishes to change the shape of one of their pills to make it easier to swallow. They propose to move from a cylindrical shaped pill to a capsule.



The pill has diameter 12mm and height 4mm.

The capsule is made up of a cylinder with a hemisphere on each end. The capsule will have diameter 7mm.

- (a) Calculate the volume of the pill correct to 2 significant figures.

3

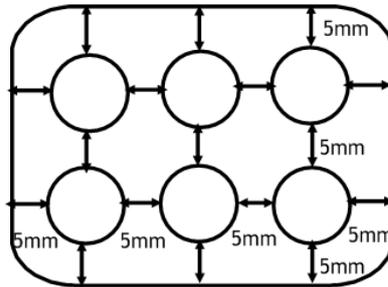
- (b) If the capsule is to have the same volume as the pill, how long will the capsule be? Give your answer correct to the nearest millimetre.

4

7.(continued)

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The pills are packed in blister packs in boxes. The blisters must be a minimum of 5mm apart. Each strip contains 6 pills and there are two strips in each box.



The blisters are designed to allow 1mm around every side of the pill.
The blisters for the pill will therefore have diameter 14mm and height 6mm.

(c) State the dimensions of the box required to fit two strips of the pills.

1

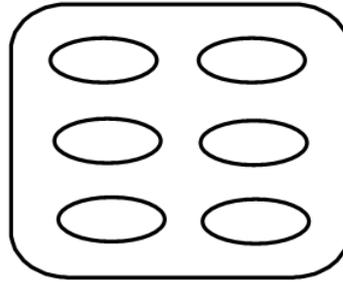
(d) State the dimensions of the blisters for the capsules.

1

7.(continued)

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The company have calculated that the capsules should be packed in the blisters as follows to minimise the surface area of the box.



- (e) Calculate the surface area of the box which will be large enough to hold two strips of capsules.

4

The cost of the boxes is directly proportional to the surface of the box.

It costs 32p for 100 boxes for the pills.

- (f) If the surface area of the box for the pills is 78.5cm^2 , calculate the cost of 100 boxes for the capsules.

2