This assignment covers *Units 11–15*.

You should be able to answer Questions 1–3 after studying Unit 11 and Chapter 11 of the Calculator Book.

Question 1

Choose the **two** options that are *true* statements about motion in a straight line.

Options

A   An object which is slowing down must have negative velocity.

B   If a vehicle has zero velocity, it must be stationary.

C   The graph of position against time for a vehicle with constant acceleration has to be a straight line.

D   Acceleration is the rate of change of velocity.

E   Velocity is the rate of change of speed.

F   A reversing vehicle must have negative velocity.

G   If two vehicles have the same velocity–time graphs, then they must have the same position–time graphs.

Question 2

By plotting the graph of the function $y = x^2 + 6x + 2$ on your calculator, or otherwise, choose the **three** options that are *true* statements about this function and its graph.

Options

A   The graph is the same as that of $y = 3x^2 + 18x + 6$.

B   The parabola has a minimum point.

C   The gradient of the parabola at $x = 0$ is 6.

D   The vertex of the parabola is at $(^-1, 3)$.

E   The vertex of the parabola is at $(^-3, ^-7)$.

F   The equation of the axis of symmetry is $y = {}^-2$.

G   The gradient of the parabola is negative when $x = 0$.

H   The intercept on the y-axis is at $y = 5$.

Question 3

Choose the **two** options that are solutions of the quadratic equation $2x^2 - 7x + 4 = 0$ correct to three decimal places.

Options

A $^-8.031$	B $^-5.969$	C $^-2.781$	D $^-0.719$
E 0.719	F 2.781	G 5.969	H 8.031

You should be able to answer Questions 4–9 after studying Unit 12 and Chapter 12 of the Calculator Book.

Question 4

An investor is considering investing £9000 over three years in a scheme which offers compound interest of 3.5% compounded annually.

Which **one** option gives the total interest paid (rounded to the nearest pound)?

Options

A £874	B £920	C £945	D £962
E £967	F £976	G £978	H £1063

Question 5

Choose the **four** options that are equal to the number 2^{18}.

Options

A 18×2^0	B 2×2^{17}	C $2^{21} - 2^3$
D $((2^6 \times 2^9) \times 2^4) \div 2$	E $(2^9)^9$	F $2^{18} \times 2^0$
G $\left(\frac{1}{2}\right)^{-18}$	H $2^7 \times (2^9 \div 2^2)$	

Questions 6 and 7

At Stage 1 of a nuclear chain reaction, one particle of barium is produced. At each of the following stages, the number of barium particles produced is three times the number that were produced at the previous stage. So at Stage 2, three barium particles are produced, and at Stage 3, nine (or 3^2) barium particles are produced.

6 Choose the **one** option that gives the formula for the number of particles of barium produced at the ninth stage.

7 Choose the **one** option that gives the *total* number of barium particles made up to and including the ninth stage.

Options for Questions 6 and 7

A 3^9	B 9^3	C 3^8	D 3×9
E 9×3^9	F 2184	G 9112	H 9841

A The equation is $Y = 2.07X^{4.66}$, with the coefficients rounded to two decimal places.

B The equation is $Y = 4.66X^{2.07}$, with the coefficients rounded to two decimal places.

C The model predicts that when $X = 3.5$, $Y = 62$ (to the nearest whole number).

D The model predicts that when $X = 3.5$, $Y = 64$ (to the nearest whole number).

E The value of the correlation coefficient shows that the curve is not a good fit to the data.

F The value of the correlation coefficient shows that the curve is a good fit to the data.

Question 11

A photocopier has settings which can reduce and enlarge copies. For example, a reduction in the ratio $4:5$ means that a length on the copy will be $\frac{4}{5}$ of the length on the original. Choose the **two** options that are *true* statements.
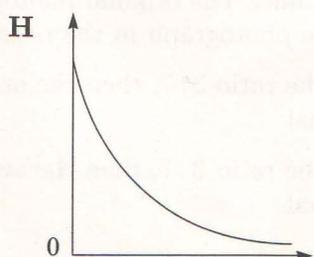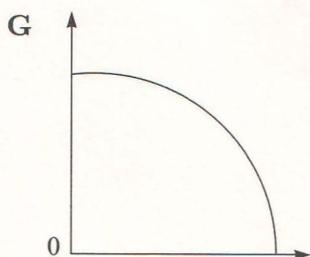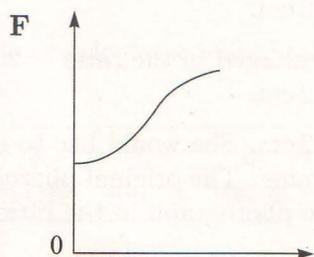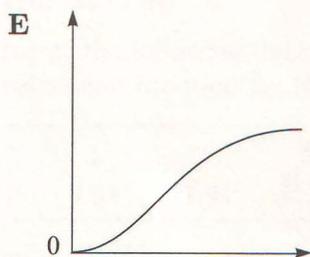
Options

A If the photocopier is set to reduce in the ratio $3:7$, then the length of a diagram that was originally $12\,\text{cm}$ long will become $5.14\,\text{cm}$ (to two decimal places).

**B** If the photocopier is set to reduce in the ratio $3:7$, then the length of a diagram that was originally $12\,\text{cm}$ long will become $28\,\text{cm}$.

C A photograph of length $8\,\text{cm}$ is to be enlarged in the ratio $5:2$. The length of the enlarged photograph is $40\,\text{cm}$.

D A photograph of length $8\,\text{cm}$ is to be enlarged in the ratio $5:2$. The length of the enlarged photograph is $32\,\text{cm}$.

E Amra has a frame which is $18\,\text{cm}$ by $12\,\text{cm}$. She would like to enlarge an old family photo to fit inside this frame. The original photograph is $3\,\text{cm}$ by $2\,\text{cm}$. Amra should enlarge the photograph in the ratio $6:1$.

F Amra has a frame which is $18\,\text{cm}$ by $12\,\text{cm}$. She would like to enlarge an old family photo to fit inside this frame. The original photograph is $3\,\text{cm}$ by $2\,\text{cm}$. Amra should enlarge the photograph in the ratio $6:4$.

G If the photocopier is set to reduce in the ratio $3:7$, then the area of copy will be $\frac{3}{7}$ of the area of the original.

H If the photocopier is set to reduce in the ratio $3:7$, then the area of copy will be $\frac{7}{3}$ of the area of the original.

These questions refer to the figures below, and the objective is to associate each of the given physical situations with a graph that could be used to model it. In each case the horizontal axis is used to represent time. For the situation described in each question, choose the **one** option that gives the best model for that situation.

12 The volume of an orange that is growing on a tree at a steady rate of $1\,cm^3$ per day.

13 The speed of a bus as it moves from one bus stop to the next, if it stops at both bus stops.

14 A bird population that is reducing by 7% per year.

Options for Questions 12 to 14

A

B

C

D

E

F

G

H
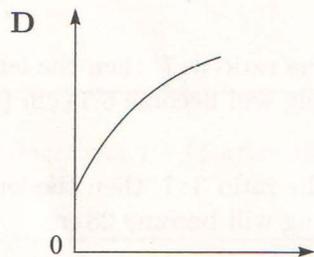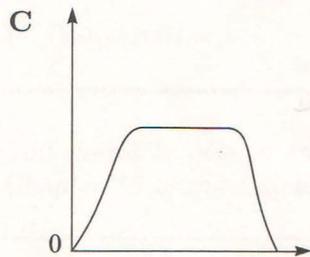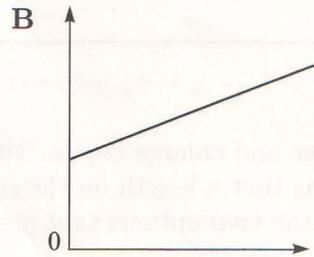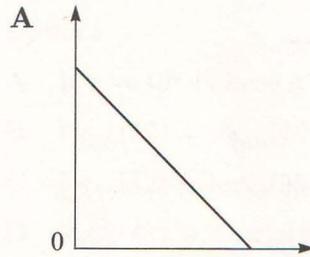
Question 15

Choose the **one** option that is the equivalent in degrees to an angle of $\frac{\pi}{3}$ radians.

Options

A 100°   **B** 120°   **C** 202.5°   **D** $\frac{\pi}{3}^{\circ}$

E 60°   **F** 90°   **G** 40.5°   **H** 0.33°

Question 16

The lengths of the sides of a triangle are 2 cm, 4 cm and 5 cm.

Each of the options below gives the lengths, in cm, of the sides of a second triangle. Choose the **three** options that specify a second triangle which is similar to the first.

Options

A 2, 4, 5   **B** 6, 12, 15   **C** 1.5, 2, 2.5   **D** $\frac{2}{3}, \frac{4}{3}, \frac{5}{3}$

E 8, 16, 25   **F** 4, 16, 25   **G** 3, 5, 6

Question 17

Compass bearings of a cairn are taken from two points, A and B, 400 m apart, along a straight north–south path, A being due north of B. The bearings of the cairn from A and B are 80° and 60°, respectively. Choose the **two** options that give the distances from A and B to the cairn, correct to the nearest metre.

Options

A 1152 m   **B** 1012 m   **C** 1057 m   **D** 769 m

E 787 m   **F** 1142 m   **G** 1013 m   **H** 978 m

You should be able to answer Questions 18–21 after studying Unit 15 and Chapter 15 of the Calculator Book.

Question 18

Choose the **two** options that are *true* for all values of x, measured in radians.

Options

A $2\sin(x) = {}^{-}2\sin(x)$ **B** $\cos^2(x) + \sin^2(x) = 1$

C $\cos(x + \pi) = \cos({}^{-}x)$ **D** ${}^{-}\cos({}^{-}x) = \cos(x)$

E $\sin(x + 3\pi) = \sin(x) + \sin(3\pi)$ **F** $\sin(x) = {}^{-}\sin({}^{-}x)$

A weight is attached to the end of a spring and pulled down to a point P, at maximum stretch. When the weight is released, it bounces up and down. Let t be the time in seconds since the weight was released, and let y be the distance in metres above P. Input the data from Table 12 into your calculator (in radian mode) and obtain the best-fit sine regression function y for the data. Plot the points and function on the same graph.

Table 12   Height of weight above position P

t/s	y/m
0	0.3
0.5	1.9
1	4.2
1.5	2.1
2	0.0
2.5	2.2
3	4.3
3.5	1.9
4	0.1
4.5	2.1
5	3.9
5.5	2.0
6	0.0

From the following statements, choose the **two** options that are *true*.

Options

A   The scatterplot and curve indicate that the sine regression curve is a poor fit to the data.

B   The scatterplot and curve indicate that the sine regression curve is a good fit to the data.

C   The equation of the best-fit curve is $y = 2.08 + 2.02\sin(3.16x - 1.62)$, where all numbers are given to two decimal places.

D   The equation of the best-fit curve is $y = 2.09 + 2.01\sin(3.16x - 1.62)$, where all numbers are given to two decimal places.

E   The equation of the best-fit curve is $y = 2.09 + 2.01\sin(^-1.62x + 3.14)$, where all numbers are given to two decimal places.

F   The equation of the best-fit curve is $y = 2.01 + 2.08\sin(3.16x - 1.62)$, where all numbers are given to two decimal places.

Questions 20 and 21

The temperature in degrees Celsius in a factory during the course of a working day, from 6 am to 10 pm, can be modelled by the function

$$H(t) = 20 + 2.5 \sin\left(\frac{\pi}{2}(t+1)\right),$$

where t is the time in hours on a 24-hour clock.

20 Choose the **one** option that is closest to the temperature in the factory predicted by the model at 11 am.

Options for Question 20

A 19.5°   **B** 20°   **C** 20.5°

D 21°   **E** 21.5°   **F** 22°

21 Choose the **two** options corresponding to the maximum and minimum temperatures during the working day.

Options for Question 21

A 16.5°   **B** 17.5°   **C** 18.5°   **D** 19.5°

E 20°   **F** 20.5°   **G** 22.5°   **H** 25°