

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	8	8	50	52	35
Section Two: Calculator-assumed	13	13	100	98	65
Total					100

Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space page.
5. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.
6. It is recommended that you do not use pencil, except in diagrams.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Additional working space

Question number: _____

(3 marks)

(b) If $f(x) = 1+x-x^3$ and $f(1)=0$, determine $f(3)$.

(3 marks)

(a) Determine the value of a .

The tangent to the curve $y=10+2x-x^2$ at $(2, 10)$ intersects the x -axis at $(a, 0)$.

(6 marks)

Question 9

Question 10**(8 marks)**

A group of 240 students were asked whether they had bought a drink or a snack from the school canteen. 72 had bought neither, 128 had bought a snack and 48 had bought both.

- (a) Determine the number of students who only bought a drink. (2 marks)

- (b) Determine the probability that a randomly chosen student from the group had bought

(i) a snack or a drink. (1 mark)

(ii) only a snack. (1 mark)

(iii) a snack given that they had bought a drink. (2 marks)

- (c) For this group of students, are the events buying a snack and buying a drink independent? Justify your answer.

(2 marks)

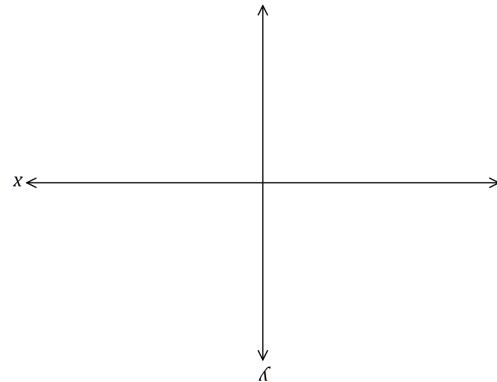
Additional working space

Question number: _____

(2 marks)

(c) Determine the equation of line L_3 that is perpendicular to L_1 and has the same y -intercept
as L_1 . (2 marks)

(2 marks)

(b) Determine the equation of line L_2 that is parallel to L_1 and passes through the point with
coordinates $(-5, -6)$. (2 marks)

(2 marks)

(a) Sketch the graph of L_1 , showing all intercepts. (2 marks)

(6 marks)

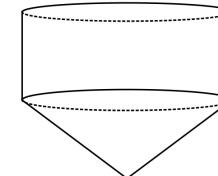
Question 11 (8 marks)

METHODS UNITS 1 AND 2

5

CALCULATOR-ASSUMED

(2 marks)

(a) Show that the volume of the solid is given by $V = 60\pi r^2 - 12\pi r^3$. (2 marks)The dimensions are such that the sum of h and $9r$ is 45 cm.A composite solid is made from a cone and a cylinder, both of height h cm and radius r cm, as
shown below.Line L_1 has equation $3y - 2x = 18$.

(8 marks)

Question 21

16

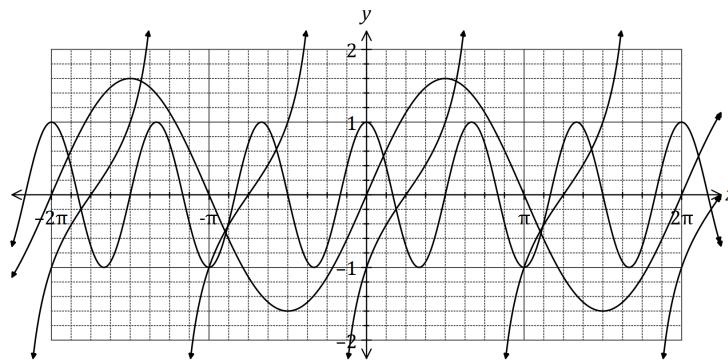
CALCULATOR-ASSUMED

METHODS UNITS 1 AND 2

(7 marks)

Question 12

- (a) The graphs of $y = a \sin x$, $y = \cos(bx)$ and $y = \tan(x+c)$ are shown below.



Determine the values of the constants a , b and c .

(3 marks)

- (b) One day, the depth of water in a tidal basin was modelled (in radians) by $d = 9.5 + 3.2 \cos(0.5t - 0.4)$, where d was the depth in metres and t was the time, in hours, after midnight. For this day, determine

(i) the depth of water at 4.30 am.

(2 marks)

(ii) the first time in the **afternoon** that the depth of water was 7 m.

(2 marks)

- (d) (i) Find the obtuse $\angle PBQ$, in radians, correct to three decimal places. (1 mark)

- (ii) Find the reflex $\angle PAQ$, in radians, correct to three decimal places. (1 mark)

- (iii) Determine the area common to both circles. Answer to one decimal place. (3 marks)

(2 marks)

(c) State the roots of the graph $y = f(2x)$.

(2 marks)

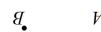
(c) Determine the length of the chord PQ to the nearest millimetre.

(1 mark)

(b) State the y -intercept of the graph $y = -5f(x)$.

(2 marks)

(b)

Show that $\angle PBA = 49.6^\circ$, when rounded to one decimal place.

(3 marks)

(a) Determine the values of the constants a , b and c .

(2 marks)

(a)

Sketch a diagram of the two circles and clearly show triangle ABP .

(6 marks)

Question 20
Two circles of radii 10 cm and 13 cm have centres at A and B respectively. The centres are 7 cm apart and the circles intersect at P and Q .
The quadratic function $f(x) = ax^2 + bx + c$ passes through $P(3, -10)$ and has roots at $x = -5$ and $x = 8$.

(11 marks)

(a)

Sketch a diagram of the two circles and clearly show triangle ABP .(a) Determine the values of the constants a , b and c .

(2 marks)

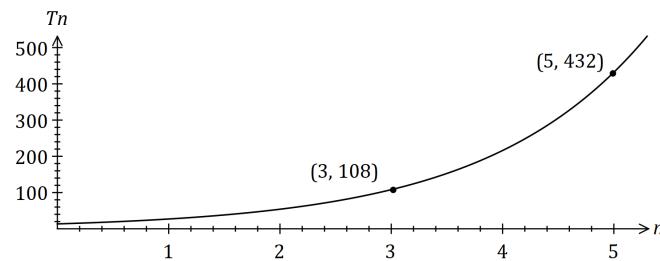
(a)

Sketch a diagram of the two circles and clearly show triangle ABP .

Question 14

(8 marks)

The number of followers of a social media influencer, counted at the start of five successive months, is shown in the exponential graph below.



The number of followers (T_n) at the start of month n can be modelled by the recursive equation
 $T_{n+1} = rT_n, T_1 = a$.

- (a) Use the graph to determine the values of r and a . (3 marks)

- (b) Assuming the growth rate continues,

- (i) how many followers are expected at the start of month 12? (1 mark)

- (ii) at the start of which month will the number of followers first exceed 750 000? (1 mark)

- (c) When the number of followers reached 1 million, the influencer fell out of favour and started to lose 25% of their followers each month. After how many months **from this time** will they have less than 2 000 followers? (3 marks)

Question 19

(8 marks)

Events A and B occur at random and it is known that $P(B) = 0.6$ and $P(A \cup B) = 0.72$.

Determine $P(A)$ when

- (a) A and B are mutually exclusive. (1 mark)

- (b) $P(A \cap B) = 0.4$. (1 mark)

- (c) $P(\bar{A} \cap B) = 0.55$. (1 mark)

- (d) $P(A|B) = 0.\dot{3}$. (2 marks)

- (e) A and B are independent. (3 marks)

(2 marks)

(d)

Determine the time(s) when the velocity of the particle is -3.6 m/s.

(1 mark)

(c)

For how long during the first five seconds is the graph decreasing?

(2 marks)

(iii)

includes at least one vowel.

(2 marks)

(b)

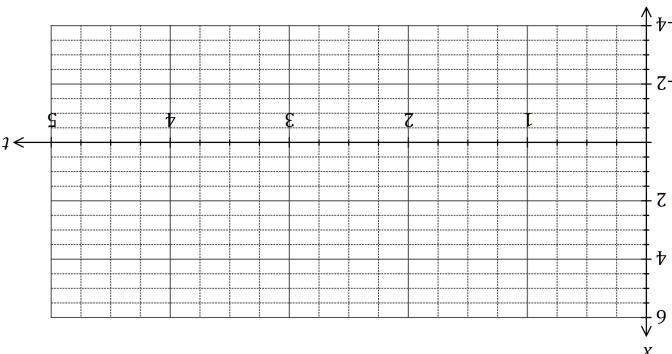
Determine the velocity of the particle when $t = 0.5$.

(2 marks)

(ii)

includes the letters M and R.

(b) Determine the probability that a random selection of five different letters



(3 marks)

(a)

Sketch the displacement of the particle on the axes below for $0 \leq t \leq 5$, labelling key points.

(2 marks)

(iii)

of five letters that contain one vowel and four consonants.

(2 marks)

(i)

of five letters.

(a) Determine the number of different selections

(8 marks)

Question 18

A particle is moving along a straight line so that its displacement, x metres, from a fixed point O after t seconds is given by

$$x = 5 - \frac{12t}{5} + \frac{5}{2}t^2$$

(8 marks)

(b)

Five different letters are selected from the eleven in the word COMRADESHP. The order in which the letters are selected is not important, so that the selection COMRA is the same as the selection RAMOC, and so on.

(c) Determine the number of different selections of five letters that contain one vowel and four consonants.

CALCULATOR-ASSUMED
METHODS UNITS 1 AND 2

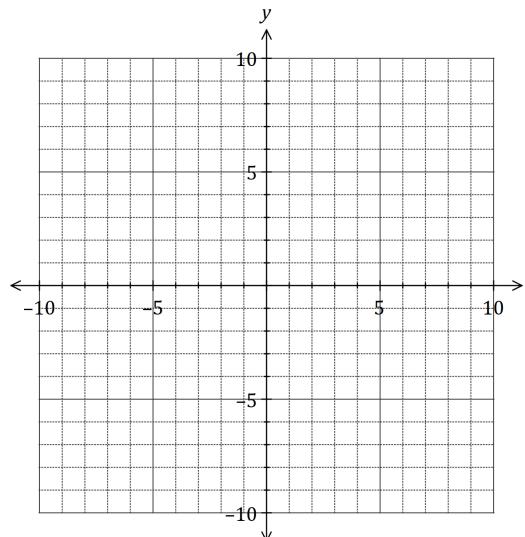
(6 marks)

Question 16

- (a) The variables x and y are related by $(x+4)^2 + (y-3)^2 = 25$.

- (i) Sketch the graph of this relationship, showing all key features.

(3 marks)



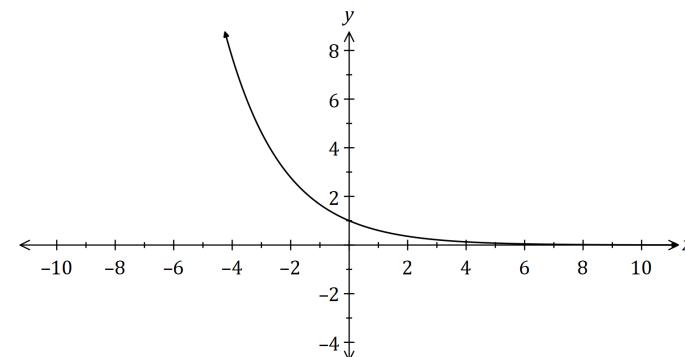
- (ii) How does the vertical line test indicate that y is not a function of x ? (1 mark)

- (b) State the domain and range of the function $f(x) = 4 - \sqrt{x+3}$. (2 marks)

(8 marks)

Question 17

- The graph of $y = a^x$ is shown below, where a is a positive constant.



- (a) On the same axes, sketch and label the graphs of

(i) $y = a^{x-3}$.

(2 marks)

(ii) $y = a^x - 2$.

(2 marks)

- (b) The graph of $y = a^{x-3}$ intersects the graph of $y = 1.2^x$ when $x = 2.1$.

Determine, giving your answers to 3 significant figures,

- (i) the y -coordinate of the point of intersection. (1 mark)