IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

MATHEMATICAL STUDIES
STANDARD LEVEL
PAPER 1

Candidate number

Tuesday 4 November 2003 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions in the spaces provided.
- Unless otherwise stated in the question, all numerical answers must be given exactly or to three significant figures.
- Write the make and model of your calculator in the appropriate box on your cover sheet *e.g.* Casio *fx-9750G*, Sharp EL-9600, Texas Instruments TI-85.

Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working. Working may be continued below the box, if necessary. Solutions found from a graphic display calculator should be supported by suitable working e.g. if graphs are used to find a solution, you should sketch these as part of your answer.

1. Using the formula $V = \pi r^2 (H - h)$, and your calculator value of π, calculate the value of V when $r = 4.26$, $H = 21.58$ and $h = 14.35$.

(a) Give the full calculator display.

(b) Give your answer to two decimal places.

(c) Give your answer to two significant figures.

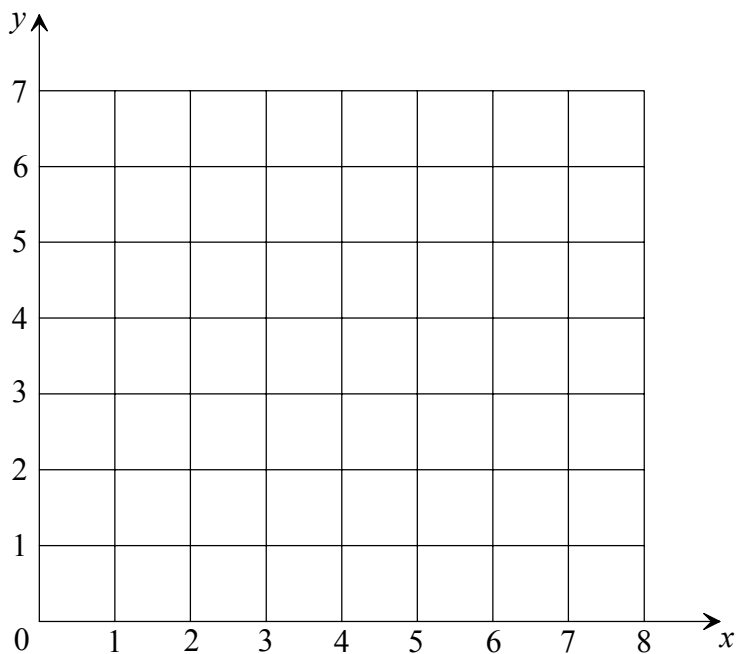(d) Write your answer to part (c) in the form $a \times 10^k$ where $1 \le a < 10$ and $k \in \mathbb{Z}$.

Working:

Answers:

(a) _____

(b) _____

(c) _____

(d) _____

2. Two points are given as A(4, 3) and B(5, 7).

(a) Plot these points on the grid below.

(b) Join the points with a straight line.

(c) Calculate the gradient of the line AB.

Working:

Answer:

(c) _____

Turn over

3. The fourth term of an arithmetic sequence is 12 and the tenth term is 42.

(a) Given that the first term is u_1 and the common difference is d, write down two equations in u_1 and d that satisfy this information.

(b) Solve the equations to find the values of u_1 and d.
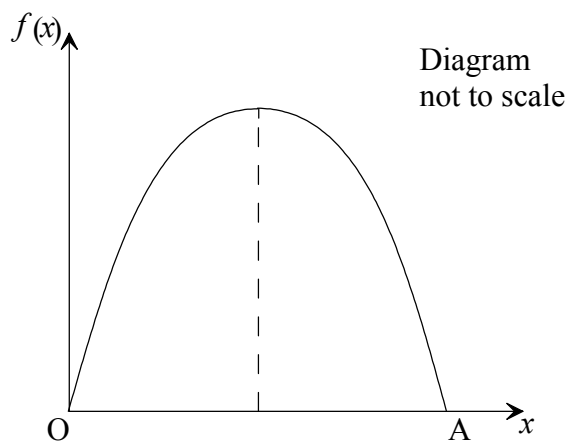
Working:

Answers:

(a) _____

_____

(b) $u_1 =$ _____

$d =$ _____

4.   The graph of the function $f : x \mapsto 30x - 5x^2$ is given in the diagram below.

Diagram not to scale

(a)   Factorize fully $30x - 5x^2$.

(b)   Find the coordinates of the point A.

(c)   Write down the equation of the axis of symmetry.

Working:

Answers:

(a) _____
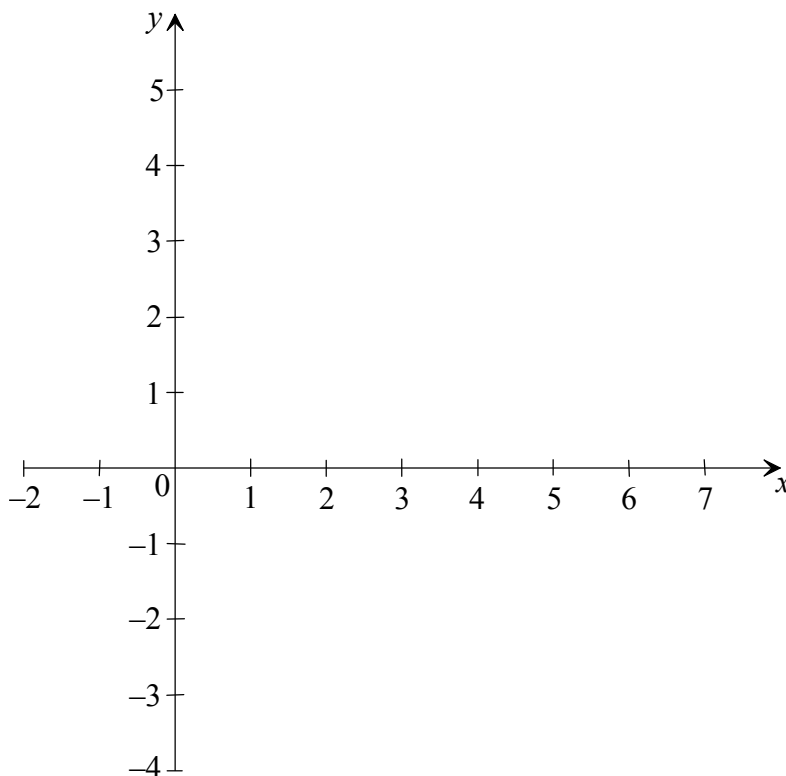
(b) _____

(c) _____

5. Consider two propositions p and q. Complete the truth table below for the compound proposition.

$$(p \wedge \neg q) \Rightarrow (\neg p \vee q)$$

p	q	$\neg p$	$\neg q$	$p \wedge \neg q$	$\neg p \vee q$	$(p \wedge \neg q) \Rightarrow (\neg p \vee q)$
T	T	F	F	F	**(d)**	T
T	F	F	T	**(b)**	F	**(f)**
F	T	**(a)**	F	**(c)**	T	**(g)**
F	F	T	T	F	**(e)**	**(h)**

Working:

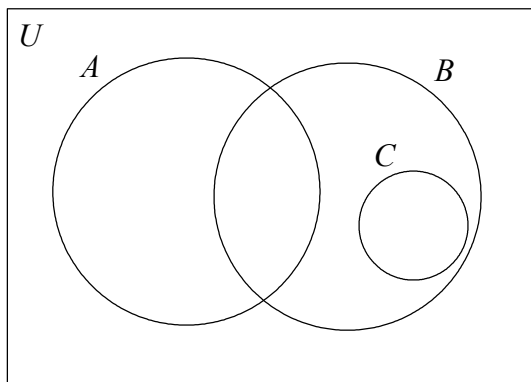**6.** (a) Draw, and label, the lines $x + y = 4$ and $y = x - 3$ on the grid below.

(b) Indicate, by shading, the region corresponding to

$x + y \leq 4$ and $y \geq x - 3$.

(c) Label this region R.

Working:

Turn over

7. The following Venn Diagram shows the sets U, A, B and C.

State whether the following statements are true or false for the information illustrated in the Venn Diagram.

(a) $A \cap C = \varnothing$

(b) $C \cup B = C$
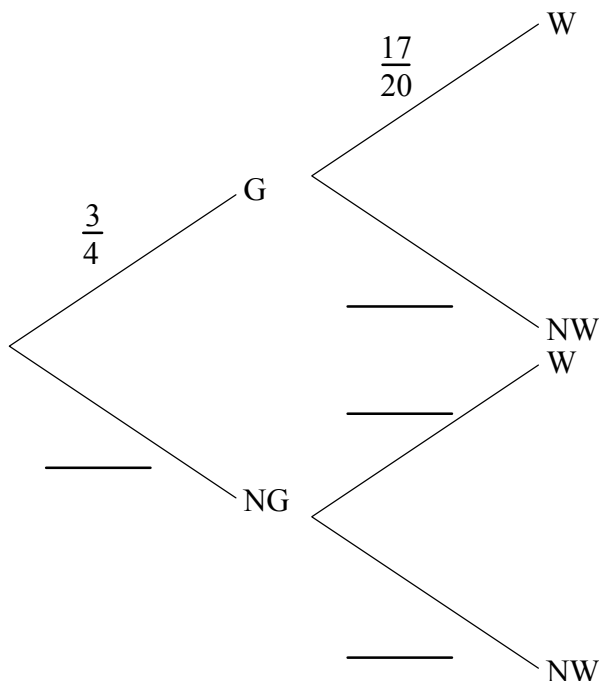
(c) $C \subset (A \cup B)$

(d) $A \subset C'$

Working:

Answers:

(a) _____

(b) _____

(c) _____

(d) _____

8. Today Philip intends to go walking. The probability of good weather (G) is $\frac{3}{4}$. If the weather is good, the probability he will go walking (W) is $\frac{17}{20}$. If the weather forecast is not good (NG) the probability he will go walking is $\frac{1}{5}$.

(a)   Complete the probability tree diagram to illustrate this information.

(b)   What is the probability that Philip will go walking?

Working:

Answer:

(b) _____

9. The vectors p and q are defined by $p = \begin{pmatrix} -7 \\ 24 \end{pmatrix}$ and $q = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$.

(a) (i) Find $|p|$.

(ii) If $|p| = k|q|$ where $k \in \mathbb{Z}$ find k.

(b) Are p and q parallel? State clearly the reason for your answer.

Working:

Answers:

(a) (i) _____

(ii) _____

(b) _____

10. Consider the function $f(x) = 2\sin x - 1$ where $0 \le x \le 720°$.

(a) Write down the period of the function.

(b) Find the minimum value of the function.

(c) Solve $f(x) = 1$.

Working:

Answers:

(a) _____

(b) _____

(c) _____

Turn over

11. David invests 6000 Australian dollars (AUD) in a bank offering 6 % interest compounded annually.

(a) Calculate the amount of money he has after 10 years.

(b) David then withdraws 5000 AUD to invest in another bank offering 8 % interest compounded annually. Calculate the **total** amount he will have in both banks at the end of one more year. Give your answer correct to the nearest Australian dollar.

Working:

Answers:

(a) _____

(b) _____

12. The frequency density histogram below shows the times, in minutes, taken by students to complete an assignment.
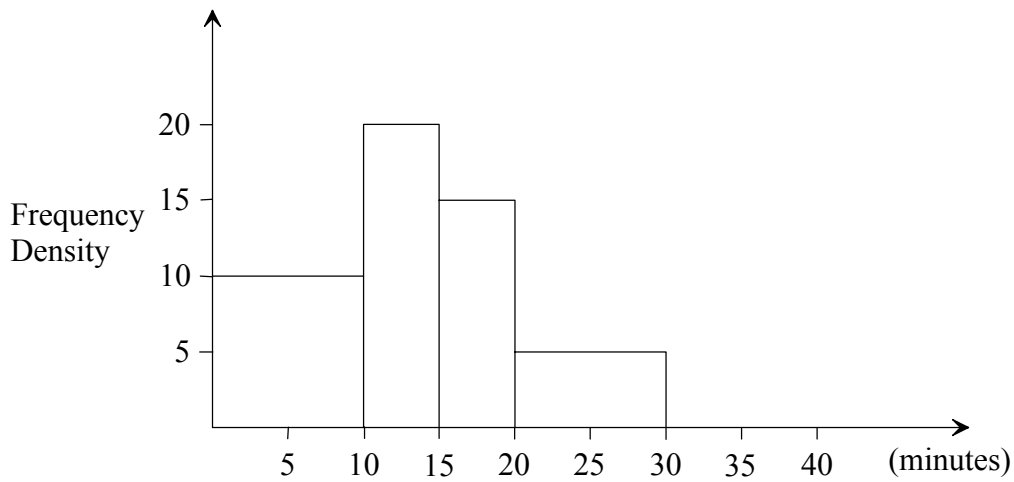
This histogram shows that 100 students took between 10 and 15 minutes to complete the assignment.

(a) How many students took between 15 and 20 minutes?

(b) How many students took between 15 and 30 minutes?

(c) 70 students took between 30 and 40 minutes. Complete the histogram above.

Working:

Answers:

(a) _____

(b) _____

Turn over

13. A Swiss bank shows currency conversion rates in a table. Part of the table is shown below, which gives the exchange rate between British pounds (GBP), US dollars (USD) and Swiss francs (CHF).

	Buy	Sell
GBP	2.3400	2.4700
USD	1.6900	1.7700

This means that the bank will **sell** its British pounds to a client at an exchange rate of
1 GBP = 2.4700 CHF.

(a)   What will be the selling price for 1 USD?

Andrew is going to travel from Europe to the USA. He plans to exchange 1000 CHF into dollars. The bank sells him the dollars and charges 2 % commission.

(b)   How many dollars will he receive? Give your answer to the nearest dollar.

Working:

Answers:

(a) _____

(b) _____

14. (a) Solve $2x + 3 = 5$.

(b) Consider the logic statements.

$p : 2x + 3 = 5$ $\qquad q : x^2 = x$

The compound proposition $2x + 3 = 5 \Rightarrow x^2 = x$ is given.

Is this compound proposition true?

(c) Write down the converse of this compound proposition.

(d) Give an example to show that the converse is false.

Working:

Answers:

(a) _____

(b) _____

(c) _____

_____

(d) _____

_____

Turn over

15. The diagrams below are sketches of some of the following functions.
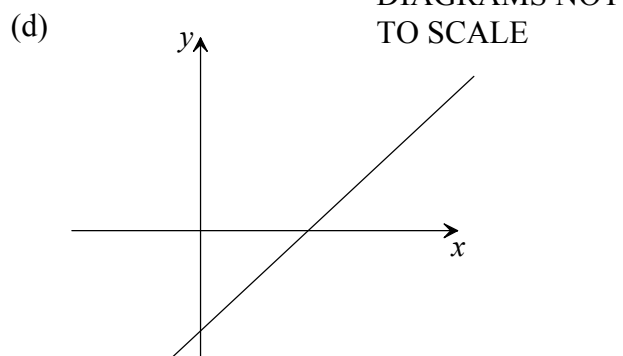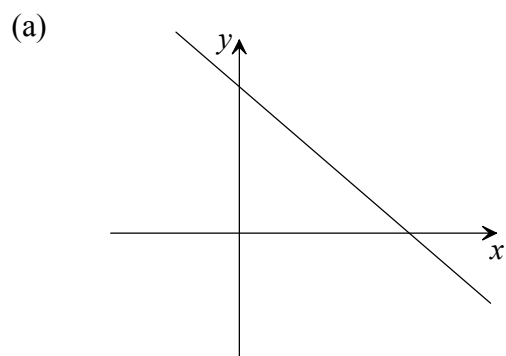
(i) $y = a^x$

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

(iii) $y = a - x^2$

(iv) $y = a - x$

(v) $y = x - a$

(a)

(b)

DIAGRAMS NOT TO SCALE

(c)

(d)
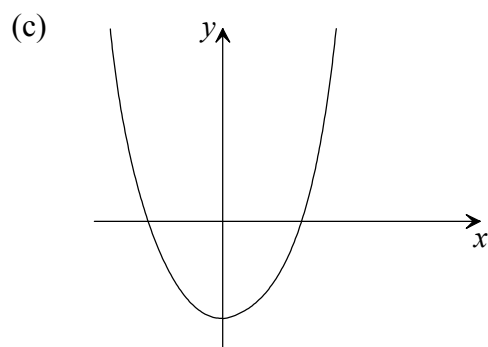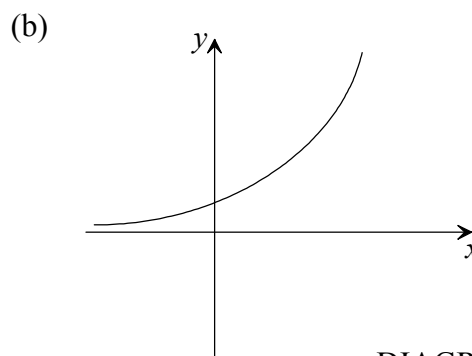
Complete the table to match each sketch to the correct function.

Sketch	Function
(a)	
(b)	
(c)	
(d)	

Working: