

Answer all the questions.

1. Expand and simplify

(a) $(5x - 6y)(5x + 6y)$

(b) $(3w - 2)(2w + 7)$

Answer:

(a) _____ [1]

(b) _____ [1]

2. Given that x and y are in direct proportion, find the value of a .

x	50	a	3375
y	2	67	135

Answer:

$a =$ _____ [2]

3. Factorise each of the following completely

(a) $2x^2 - 8y^2$,

(b) $36a^2 + 9a - 10$

Answer:

(a) _____ [2]

(b) _____ [2]

4. Solve the following simultaneous equations

$$4x + 9y = -25,$$

$$2x - \frac{4}{3}y = 5.$$

Answer:

$$x = \underline{\hspace{2cm}} \quad y = \underline{\hspace{2cm}} \quad [3]$$

5. Solve

(a) $(4x - 3)(x + 2) = 0$,

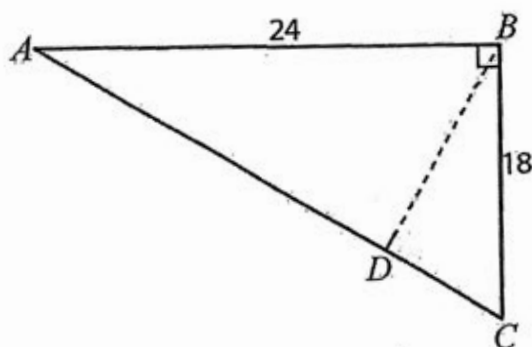
(b) $y(2y - 15) = -18$.

Answer:

(a) $x = \underline{\hspace{2cm}}$ [1]

(b) $y = \underline{\hspace{2cm}}$ [3]

6. In the figure below, ADC is a straight line and $\angle ABC = 90^\circ$. Given that $AB = 24$ cm and $BC = 18$ cm,

(a) find the length of AC .(b) Hence, find the length of BD .(c) If $DC = 10.8$ cm, prove that $\triangle BDC$ is a right-angled triangle. [2]*Answer:*

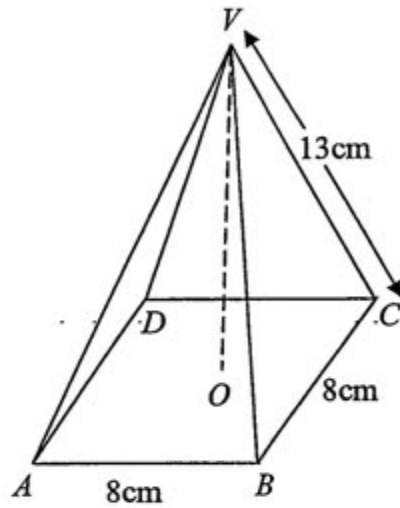
(a) $\underline{\hspace{2cm}}$ [2]

(b) $\underline{\hspace{2cm}}$ [2]

7. $ABCDV$ is a pyramid with a square base of sides 8 cm.

VO is vertical and $VC = 13$ cm.

- Find the length of OC .
- Find the vertical height VO .
- Hence, find the volume of the pyramid.



Answer:

(a) _____ [2]

(b) _____ [2]

(c) _____ [2]

8. Simplify the following.

(a) $\frac{3b(4a)^2}{9b}$,

(b) $\frac{2x^2 + 3x - 35}{x^2 - 25}$.

Answer:

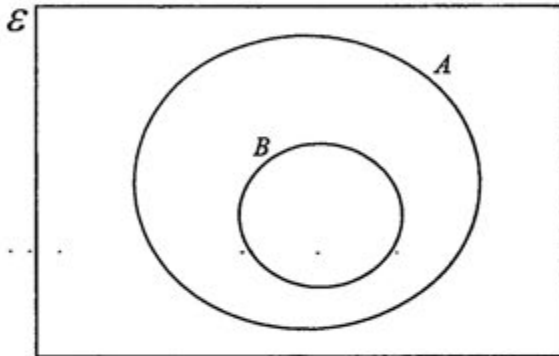
(a) _____ [2]

(b) _____ [2]

9. Shade the following sets in the respective Venn diagrams below.

(a) $A \cap B'$

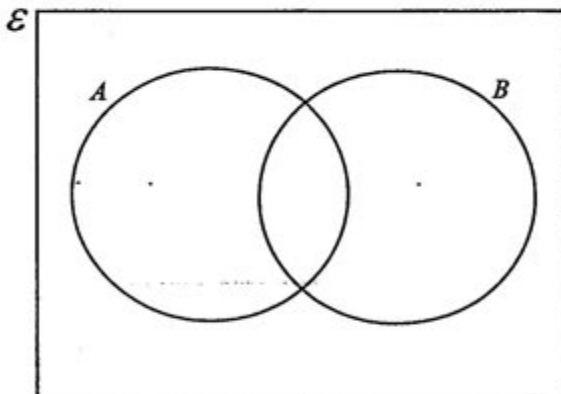
Answer:



[1]

(b) $(A \cap B) \cup A'$

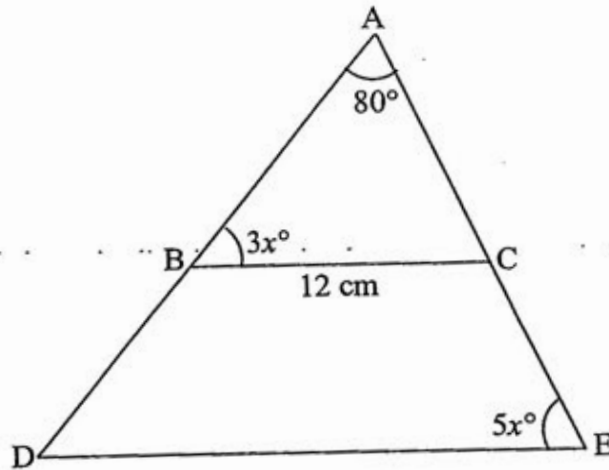
Answer:



[1]

10. In the diagram below, $\triangle ABC$ and $\triangle ADE$ are similar, find

- (a) x ,
- (b) $\angle ACB$,
- (c) $\angle ADE$,
- (d) length of DE if the scale factor is 1.5.



Answer:

- (a) _____ [2]
- (b) $\angle ACB =$ _____ $^{\circ}$ [1]
- (c) $\angle ADE =$ _____ $^{\circ}$ [1]
- (d) _____ cm [2]

11. A six sided die is thrown 35 times. The results are shown in the table below.

Number shown on die	1	2	3	4	5	6
Frequency	8	x	6	5	4	3

Find

- (a) (i) the value of x ,
 (ii) the mode,
 (iii) the mean,
 (iv) the median.
- (b) Hence, find the probability that the number shown on the die is less than 4.

Answer:

(a)(i) _____ [1]

(ii) _____ [1]

(iii) _____ [2]

(iv) _____ [1]

(b) _____ [1]

12. Given that $\varepsilon = \{1, 2, 3, 4, 6, 9, 10, 11, 12, 18, 30, 32, 36\}$, $A = \{x: x \text{ is a multiple of } 4\}$,
 $B = \{x: x \text{ is a prime number}\}$, $C = \{1, 2, 3, 6\}$

(a) List the elements of the set

(i) A ,

(ii) B ,

(iii) $B \cap C$.

(b) Find the value of $n(A \cup C)'$

(c) Is $\{12, 36\} \subset A$?

Answer:

(a)(i) _____ [1]

(ii) _____ [1]

(iii) _____ [1]

(b) _____ [1]

(c) _____ [1]

END OF PAPER

ANSWERS:

1(a) $25x^2 - 36y^2$

1(b) $6w^2 + 17w - 14$

2(a) $y = kx$

$$k = \frac{y}{x}$$

$$k = \frac{1}{25} \text{ (1 m)}$$

$$y = \frac{1}{25}x$$

$$67 = \frac{x}{25}$$

$$x = 1675 \text{ (1 m)}$$

3(a) $2(x^2 - 4y^2)$ (1 m)

$$= 2(x - 2y)(x + 2y)$$
 (1 m)

3(b) $(12a - 5)(3a + 2)$ (2 m)

4. Using elimination method: (2) \times 2:

$$4x - \frac{8}{3}y = 10 - (3)$$

$$(1) - (3): 4x + 9y - (4x - \frac{8}{3}y) = -25 - 10$$
 (1 m)

$$y = -3$$
 (1 m)

$$x = 0.5 / \frac{1}{2}$$
 (1 m)

5(a) $x = \frac{3}{4}, x = -2$ (1 m)

$$2y^2 - 15y + 18 = 0$$

5(b) $(2y - 3)(y - 6) = 0$ (3 m)

$$y = \frac{3}{2}, y = 6$$

6(a) $AC^2 = 24^2 + 18^2$ (1 m)

$$AC = 30 \text{ cm}$$
 (1 m)

6(b) Area of triangle = $0.5 \times 18 \times 24 = 216 \text{ cm}^2$ (1 m)

$$\text{Since } BD \times 0.5 \times 30 = 216 \Rightarrow BD = 14.4 \text{ cm}$$
 (1 m)

$$6(c) \quad BC^2 = 18^2 = 324$$

$$BD^2 + DC^2 = 14.4^2 + 10.8^2 = 324 \quad (1 \text{ m})$$

Since $BC^2 = BD^2 + DC^2$, therefore $\triangle BDC$ is a right-angled triangle. (proven) (1 m)

$$7(a) \quad AC^2 = 8^2 + 8^2 = \sqrt{128} \quad (1 \text{ m})$$

$$OC = \frac{\sqrt{128}}{2} = 5.66 \text{ cm} \quad (1 \text{ m})$$

$$7(b) \quad VO^2 + OC^2 = 13^2$$

$$VO^2 + \left(\frac{\sqrt{128}}{2}\right)^2 = 13^2 \quad (1 \text{ m})$$

$$VO = 11.7 \text{ cm} \quad (1 \text{ m})$$

$$7(c) \quad \text{Volume} = \frac{1}{3} \times 8 \times 8 \times 11.7047 \quad (1 \text{ m})$$

$$= 249.7 = 250 \text{ cm}^3 \quad (3 \text{ sig fig}) \quad (1 \text{ m})$$

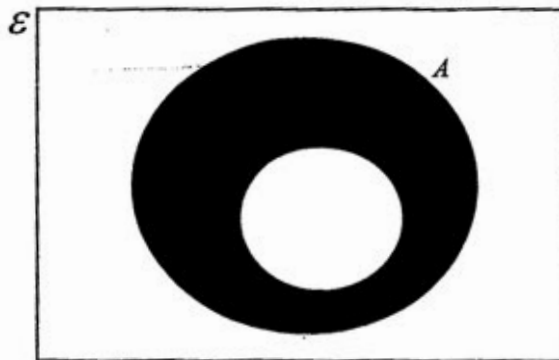
$$8(a) \quad \frac{3b \times 4a \times 4a}{9b} \quad (1 \text{ m})$$

$$= \frac{16a^2}{3} \quad (1 \text{ m})$$

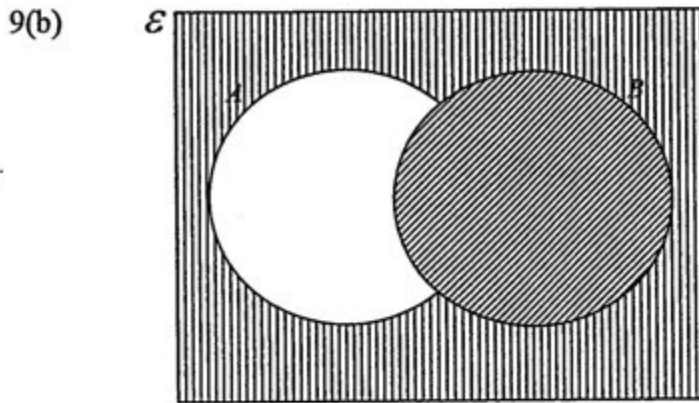
$$8(b) \quad \frac{(2x-7)(x+5)}{(x-5)(x+5)} \quad (1 \text{ m})$$

$$= \frac{2x-7}{x-5} \quad (1 \text{ m})$$

9(a)



$A \cap B'$



$$(A \cap B) \cup A'$$

10(a) $\angle BCA = 5x^\circ$ (corresponding angles) (1 m)

$$5x^\circ + 3x^\circ + 80^\circ = 180^\circ \text{ (sum of angles in a triangle)}$$

$$8x^\circ = 120$$

$$x^\circ = 12.5 \text{ (1 m)}$$

10(b) $\angle ACB = 62.5^\circ$

10(c) $\angle ADE = 37.5^\circ$

10(d) Scale factor = $\frac{DE}{BC}$

$$\frac{DE}{BC} = 1.5 \text{ (1 m)}$$

$$DE = 18 \text{ cm (1 m)}$$

11(a)(i) $x = 9$

11(a)(ii) mode = 2

11(a)(iii) $mean = \frac{8+18+18+20+20+18}{35}$ (1 m)

$$= 2.91 \text{ (3 sig fig) (1 m)}$$

11(a)(iv) median = 3

11(b) P (number is less than 4) = $\frac{23}{35}$

12(a)(i) $A = \{4, 12, 32, 36\}$

12(a)(ii) $B = \{2, 3, 11\}$

12(a)(iii) $B \cap C = \{2, 3\}$

12(b) $n(A \cup C)' = 13 - n(A \cup C) = 13 - 8 = 5$

12(c) Yes



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MATHEMATICS

4016/02

PAPER 2

FRIDAY 5 OCTOBER 2012

1010 – 1125 HRS
1 HOUR 15 MINUTES

READ THESE INSTRUCTIONS FIRST

Write your Class, index number and name on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

Calculators should be used where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examination, fasten all work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 50.

For Examiner's Use	
Total	/ 50

Mathematical Formulae*Compound interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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

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

$$\text{Area of a triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

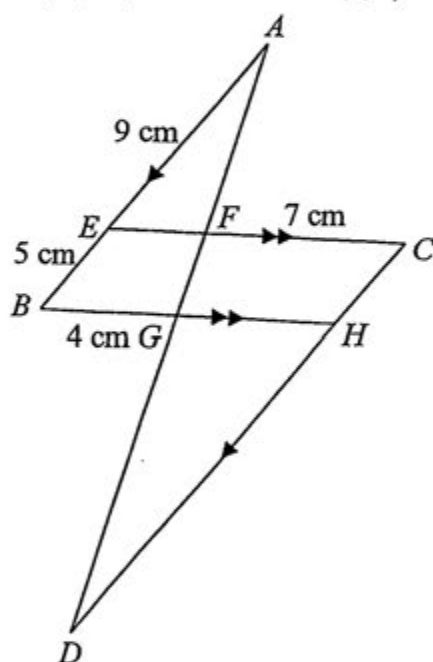
Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer all the questions.

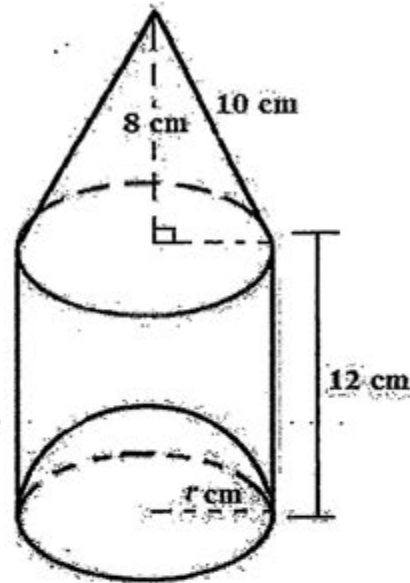
1. (a) A card is drawn at random from an ordinary pack of 52 playing cards. Find the probability that the card drawn is
- (i) the ace of spade, [1]
 - (ii) a king or a queen, [1]
 - (iii) a joker. [1]
- (b) In the diagram, $BECH$ is a parallelogram and $AFGD$, AEB and CHD are straight lines.



Given that $AE = 9$ cm, $EB = 5$ cm, $BG = 4$ cm and $FC = 7$ cm, calculate

- (i) EF , [2]
- (ii) GH , [1]
- (iii) DH . [2]

2. The object below consists of a solid cylinder with a solid conical top and a hollow hemispherical base. The conical top has a vertical height of 8 cm and a slant height of 10 cm. The cylinder has a height of 12 cm and the hemispherical base has a radius of r cm.



- (a) Show that the value of r is 6. [2]
- (b) Find the volume of object in terms of π . [3]
- (c) Find the total surface area of the object. [3]
-
3. (a) The price of salmon in Singapore was x dollars per kg in January 2012. In September 2012, the price has increased by \$2.50 per kg.
- (i) Heng Caterers bought \$250 of salmon in January 2012. Express the amount of salmon (in kg) bought in terms of x . [1]
- (ii) Find the amount of salmon (in kg) bought by Heng Caterers with \$250 in September 2012. Express your answer in terms of x . [1]
- (iii) If the difference in the weight of salmon bought in January and September is 5 kg, form an equation in x and show that it reduces to $2x^2 + 5x - 250 = 0$ [3]
- (iv) Solve the equation in (iii) and use it to find the weight (in kg) of salmon that can be bought in September 2012. [3]
- (b) Without using calculator, evaluate 493×507 using special products of algebraic expressions. [2]
-

4. (a) A map is drawn to a scale of 5: 100 000. A highway on the map has a length of 15.5 cm. Find
- the actual length of the highway in km. [2]
 - the area of a school, in cm^2 , on the map if the actual area of the school is 30 km^2 . [2]
- (b) It is given that:
 $\varepsilon = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $E = \{2, 4, 6, 8\}$
 $S = \{1, 4, 9\}$
 Draw a clearly labelled Venn diagram to illustrate the relationship between ε , E and S . [2]

5. The time taken, in minutes, by 30 students to complete an e-learning assignment are given below.

9 37 18 25 47 14 28 20 35 42 28 39 27 40 28
 21 55 54 49 16 25 38 30 55 42 35 28 41 35 39

- (i) Construct a single ordered stem and leaf diagram to represent the time taken by all 30 students. Part of the diagram has been drawn for you. Copy and complete the diagram. [2]

Stem	Leaf
0	9
1	
2	
3	
4	
5	

Key: 1|8 means 18 minutes

- Find the modal and median time taken by the class. [2]
- Find the mean time taken by the class. [1]
- Students who took less than half an hour to complete the e-learning assignment are told to re-do the assignment. Express, as a percentage, the number of students required to re-do the assignment. [1]

6. Answer the whole of this question on a piece of graph paper.

The variables x and y are related by the equation $y = -x^2 + 2x + 3$

x	-2	-1	0	1	2	3	4
y	-5	0	3	a	3	b	-5

- (a) Find the values of a and of b . [2]
- (b) Using a scale of 2 cm to 1 unit on the x -axis and 2 cm to 2 units on the y -axis, draw the graph of $y = -x^2 + 2x + 3$ for values of x in the range of $-2 \leq x \leq 4$. [3]
- (c) From the graph, find
- (i) the value(s) of x when $y = 1$, [2]
 - (ii) the equation of the line of symmetry, [1]
 - (iii) the coordinates of the maximum point, [1]
 - (iv) the y -intercept. [1]
- (d) By drawing a straight line graph, find the solutions of $-x^2 + 2x + 3 = x$ from the graph. [2]

END OF PAPER