

End of Year Examination Paper 2

INSTRUCTION TO CANDIDATES:

1. Answer **all** questions.
2. Write your answers and working in the spaces provided.
3. Omission of essential working will result in loss of marks.
4. Calculators may be used in this paper.
5. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer correct to three significant figures. Give answers in degrees correct to one decimal place.

Marks Obtained
50

Duration: 1h 30 min

- 1** (a) A worker received a salary increase of 7%. If his new salary is \$1605, find his original salary.
- (b) The original price of a table is \$576. Due to inflation, the price increased the following month to become \$610. Find the percentage increase, giving your answer correct to 4 significant figures.

Ans: (a) \$ _____ [2]

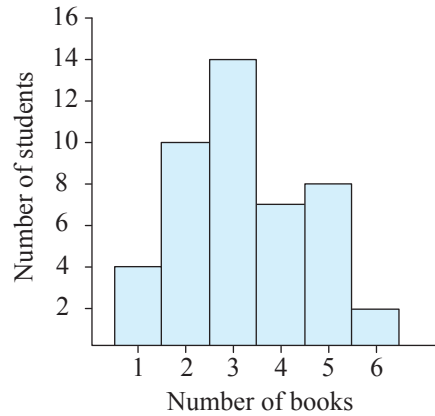
(b) _____ % [2]

- 2** (a) Simplify $\frac{4x}{x+3} \div \frac{x^2-x}{x^2+2x-3}$.
- (b) Express $\frac{2}{7} - \frac{x+4}{x+5}$ as a single fraction in its simplest form.

Ans: (a) _____ [3]

(b) _____ [2]

- 3 The histogram below shows the average number of books each student puts in his/her school bag everyday.

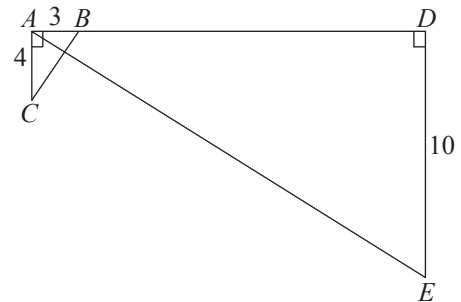


- (a) What is the fraction of students who carry an average of two books to school daily?
 (b) Find the angle of the sector on a pie chart representing five books.

Ans: (a) _____ [1]

(b) _____ ° [2]

- 4 In the figure below, $\triangle ABC$ is similar to $\triangle DEA$. Given that $AB = 3$ cm, $DE = 10$ cm, $AC = 4$ cm and $\angle BAC = \angle ADE = 90^\circ$. Find
- (a) $\angle DAE$,
 (b) the length of AD ,
 (c) the area of the trapezium $ADEC$.

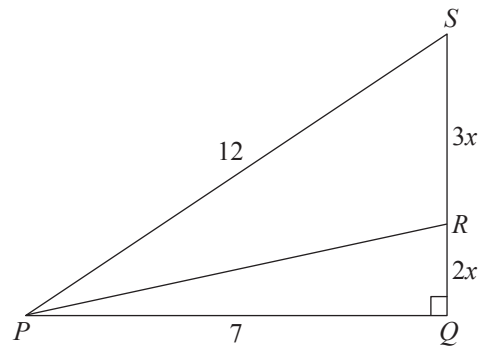


Ans: (a) $\angle DAE =$ _____ ° [2]

(b) $AD =$ _____ cm [2]

(c) _____ cm^2 [1]

- 5 In $\triangle PQR$, $\angle PQS = 90^\circ$, $RS = 3x$ cm, $RQ = 2x$ cm, $PQ = 7$ cm and $PS = 12$ cm.
Find
- the value of x ,
 - $\angle RPQ$.



Ans: (a) $x =$ _____ [2]

(b) $\angle RPQ =$ _____ $^\circ$ [2]

- 6 The stem-and-leaf diagram shows the weight of 26 gold coins during a quality check.

Stem	Leaf
25	7 7 7 7 8 9
26	0 0 0 1 1 3 5 8 8 9 9
27	0 1 1 1 2 2 6 7 7

Key: 25|4 represents 25.4 grams

Find

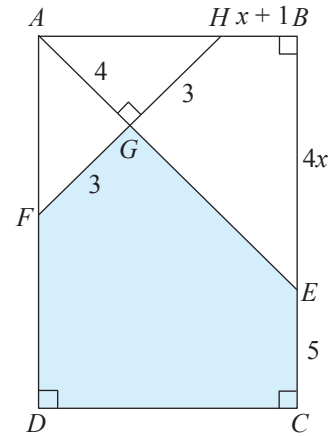
- the ratio of the number of coins weighing less than 26 g to those weighing more than 27 g,
- the modal weight,
- the median weight.

Ans: (a) _____ : _____ [2]

(b) _____ grams [1]

(c) _____ grams [1]

- 7** In the diagram, $ABCD$ is a rectangle, $AG = 4$ cm, $GH = FG = 3$ cm, $HB = (x + 1)$ cm, $BE = 4x$ cm and $CE = 5$ cm. The area of the shaded region is 93 cm².
- (a) Find the area of $\triangle ABE$ in terms of x .
- (b) Form an equation in x and show that it simplifies to become $2x^2 + 17x - 69 = 0$. [3]
- (c) Solve the equation in (b) and find the area of $\triangle ABE$.

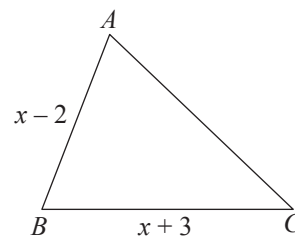
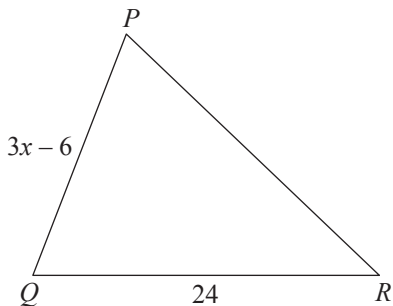


Ans: (a) _____ cm² [2]

(c) _____ cm² [3]

- 8** In the diagram, triangle ABC is a reduction of triangle PQR . The dimensions given are in cm.

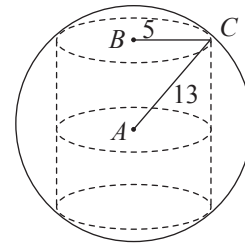
- (a) Show that the scale factor of the enlargement is $\frac{1}{3}$. [2]
- (b) Hence, form an equation in terms of x and solve it.
- (c) Find the length of PQ .



Ans: (b) $x =$ _____ [3]

(c) $PQ =$ _____ cm [1]

- 9 The diagram shows a solid cylinder inscribed within a spherical ball of radius 13 cm and centre A . The base radius of the cylinder is 5 cm with centre B . Calculate the
- volume of the sphere,
 - height of the cylinder,
 - empty volume of space within the sphere not occupied by the cylinder.



Ans: (a) _____ cm^3 [1]
 (b) _____ cm [2]
 (c) _____ cm^3 [1]

10 Answer the whole of this question on graph paper.

- (a) A table of values for the equation $y = -2x^2 + 3x + 2$ is shown below.

x	-2	-1	0	1	2	3	4
y	-12	p	2	3	0	q	-18

Calculate the values of p and q . [2]

- (b) Using a scale of 2 cm to 1 unit on the x -axis and a scale of 1 cm to 1 unit on the y -axis, draw the graph of $y = -2x^2 + 3x + 2$ for $-2 \leq x \leq 4$. [2]
- (c) Use your graph to estimate
- the value of y when $x = 2.5$, [1]
 - the maximum value of y , [1]
 - the equation of the line of symmetry. [1]

Solutions to:

End of Year Examination Paper 2

1. (a) Original salary = $\frac{\$1605}{107} \times 100$
 = \$1500
- (b) Percentage increase = $\frac{610 - 576}{576} \times 100\%$
 ≈ 5.902778
 = 5.903% (4 s.f.)
2. (a) $\frac{4x}{x+3} \div \frac{x^2-x}{x^2+2x-3} = \frac{4x}{x+3} \times \frac{x^2+2x-3}{x^2-x}$
 $= \frac{4x}{x+3} \times \frac{(x+3)(x-1)}{x(x-1)}$
- (b) $\frac{2}{7} - \frac{x+4}{x+5} = \frac{2(x+5) - 7(x+4)}{7(x+5)}$
 $= \frac{2x+10-7x-28}{7(x+5)}$
 $= \frac{-5x-18}{7(x+5)}$ or $-\frac{5x+18}{7(x+5)}$
3. (a) Total number of students
 = 4 + 10 + 14 + 7 + 8 + 2
 = 45
 Required fraction = $\frac{10}{45}$
 $= \frac{2}{9}$
- (b) Angle of sector = $\frac{8}{45} \times 360^\circ$
 = 64°
4. (a) Since $\triangle ABC$ is similar to $\triangle DEA$,
 $\angle DAE = \angle ACB$
 $= \tan^{-1}\left(\frac{3}{4}\right)$
 $\approx 36.869^\circ$
 = 36.9° (1 d.p.)
- (b) $\frac{AC}{AD} = \frac{AB}{DE}$
 $\frac{4}{AD} = \frac{3}{10}$
 $3AD = 40$
 $AD = 13\frac{1}{3}$ cm
- (c) Note that $AC \parallel DE$.
 \therefore area of trapezium $ADEC$
 $= \frac{1}{2}(AC + DE) \times AD$
 $= \frac{1}{2}(4 + 10) \times 13\frac{1}{3}$
 $= 93\frac{1}{3}$ cm²
5. (a) Since $\triangle PQS$ is a right-angled triangle, by the Pythagoras' Theorem,
 $7^2 + (5x)^2 = 12^2$ $QS = 2x + 3x = 5x$ cm
 $49 + 25x^2 = 144$
 $25x^2 = 144 - 49$
 $x^2 = \frac{95}{25}$
 $x = \pm\sqrt{\frac{95}{25}}$
 ≈ 1.94935 or -1.94935 (rej.)
 = 1.95 (3 s.f.)
- (b) $\tan \angle RPQ = \frac{QR}{PQ}$
 $= \frac{2(1.94935)}{7}$ use at least 5 s.f.
 ≈ 0.556957
 $\angle RPQ = \tan^{-1}(0.556957)$
 $= 29.1^\circ$ (1 d.p.)
6. (a) Required ratio = 6 : 8
 = 3 : 4
- (b) Modal weight = 25.7 g
- (c) Median = $\left(\frac{26+1}{2}\right)^{\text{th}}$ number
 = 13.5th number mean of 13th and 14th values
 $= \frac{26.5 + 26.8}{2}$
 = 26.65 g
7. (a) Since $\triangle AGH$ is a right-angled triangle,
 $4^2 + 3^2 = AH^2$ (By Pythagoras' Theorem)
 $AH^2 = 25$
 $AH = \pm\sqrt{25}$
 $= 5$ cm or -5 cm (rej.)
 $AB = 5 + (x + 1)$
 $= (6 + x)$ cm
 Area of $\triangle ABE = \frac{1}{2} \times AB \times BE$
 $= \frac{1}{2}(6 + x)(4x)$
 $= (12x + 2x^2)$ cm²
- (b) Shaded region = Area $ABCD$ - Area $\triangle ABE$ - Area $\triangle AGF$
 $93 = (6 + x)(4x + 5) - (12x + 2x^2) - \frac{1}{2}(3)(4)$
 $93 = 24x + 30 + 4x^2 + 5x - 12x - 2x^2 - 6$
 $93 = 2x^2 + 17x + 24$
 $\therefore 2x^2 + 17x - 69 = 0$ (shown)

$$(c) \quad 2x^2 + 17x - 69 = 0$$

$$(2x + 23)(x - 3) = 0$$

×		x	-3
2x		2x ²	-6x
23		23x	-69

$$2x + 23 = 0 \quad \text{or} \quad x - 3 = 0$$

$$x = -\frac{23}{2} \text{ (rej. } \because x > 0) \quad \text{or} \quad x = 3$$

$$\therefore x = 3$$

$$\text{Area of } \triangle ABE = 12(3) + 2(3^2) \quad (12x + 2x^2) \text{ cm}^2$$

$$= 54 \text{ cm}^2$$

8. (a) Scale factor = $\frac{AB}{PQ}$

$$= \frac{x-2}{3x-6}$$

$$= \frac{\cancel{x-2}}{3(\cancel{x-2})}$$

$$= \frac{1}{3} \quad (\text{shown})$$

(b) $\frac{1}{3} = \frac{x+3}{24}$

$$24 = 3(x+3)$$

$$24 = 3x + 9$$

$$3x = 15$$

$$x = 5$$

(c) $PQ = 3(5) - 6$

$$= 9 \text{ cm}$$

9. (a) Volume of sphere = $\frac{4}{3}\pi(13^3)$

$$\approx 9202.77$$

$$= 9200 \text{ cm}^3 \text{ (3 s.f.)}$$

(b) Since $\triangle ABC$ is a right-angled triangle, by the Pythagoras' Theorem,

$$AB^2 = 13^2 - 5^2$$

$$= 144$$

$$AB = \pm\sqrt{144}$$

$$= 12 \text{ cm or } -12 \text{ cm (rej.)}$$

\therefore height of cylinder = $2 \times 12 \text{ cm}$ by symmetry

$$= 24 \text{ cm}$$

(c) Volume of empty space = $9202.77 - \pi(5^2)(24)$

$$\approx 7317.814$$

$$= 7320 \text{ cm}^3 \text{ (3 s.f.)}$$

10. (a) Substituting $x = -1$,

$$p = -2(-1)^2 + 3(-1) + 2$$

$$= -3$$

Substituting $x = 3$,

$$q = -2(3)^2 + 3(3) + 2$$

$$= -7$$

(b) (See diagram 10. (b) on page S3.)

(c) (i) $y = -3$

(ii) $y = 3.2$

(iii) $x = 0.8$ (accept ± 0.1)

10. (b)

