

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

1 Express 15 000 micrometres per second into metres per hour.

Answer m/h [2]

2 Mr Ho received a salary of \$2 400 in November. In December, his salary was increased by 5% and he was also given a bonus of \$72. Calculate the percentage increase in his earnings in December.

Answer % [2]

3 A cannon is loaded with 3 shells to fire at a target. The probability that a shell hits the target is $\frac{2}{5}$. A hit from a single shell is enough to destroy the target completely. What is the probability that the target will be destroyed?

Answer [2]

- 4 On 12 November 2008, a man borrowed some money from a bank at a rate of 7.5% per annum simple interest to renovate his house. On 12 April 2009, the interest amounted to \$781.25. How much money did he borrow from the bank?

Answer \$ [2]

- 5 An accurate scale model of a statue is made. The height of the model is one-ninth the height of the statue. If it costs \$2.25 to paint the model, how much does it cost to paint the statue using the same type of paint?

Answer \$ [2]

- 6 (a) Express 23716 as a product of its prime factors, leaving your answer in index notation.
- (b) Find the smallest positive integer k such that $23716k$ is a perfect cube.

Answer (a) [1]

(b) $k =$ [1]

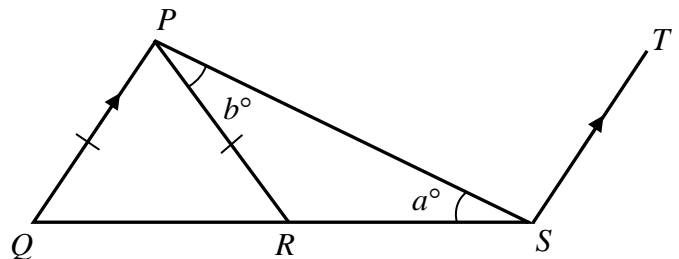
- 7 Tap A fills a pool in 18 minutes and tap B does so in 36 minutes. How long will it take both taps, running together, to fill the pool?

Answer mins [2]

- 8 If 0.5 litres of air contains 1 375 650 oxygen molecules, how many oxygen molecules are there in 1 cubic centimetre of air? Give your answer in standard form.

Answer [2]

- 9 In the diagram, $PQ = PR$ and PQ is parallel to TS . Given that $\angle PSR = a^\circ$ and $\angle RPS = b^\circ$, express angle PST in terms of a and b .



Answer $\angle PST = \dots\dots\dots^\circ$ [2]

10 Without using a calculator, simplify $\sqrt[3]{4} \times \sqrt[4]{16} \times 2^{\frac{2}{6}}$.

Answer [2]

11 Simplify $(2a^{-3}b)^{-2} \div \frac{4}{3}a^2b^{-1}$, leaving your answer in positive indices.

Answer [3]

12 The scale of a map of a housing estate is 1 : 20 000 .

(a) A road on the map is 4.5 cm long. Calculate the actual length of the road, giving your answer in metres.

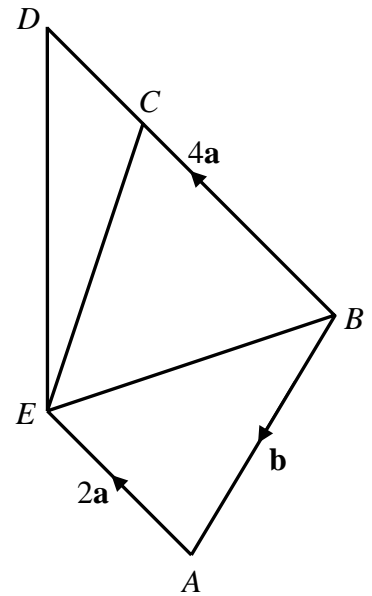
(b) The housing estate occupies an area of 100 cm^2 on the map. On another map of scale 1 : 40 000 , what is the area that will be occupied by the same housing estate? Give your answer in cm^2 .

Answer (a)..... m [1]

(b)..... cm^2 [2]

13 $ABDE$ is a quadrilateral in which $\overline{AE} = 2\mathbf{a}$, $\overline{BD} = 4\mathbf{a}$, $\overline{BA} = \mathbf{b}$ and $\overline{BC} = 3\overline{CD}$. It is given that $\mathbf{a} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -2 \\ -3 \end{pmatrix}$.

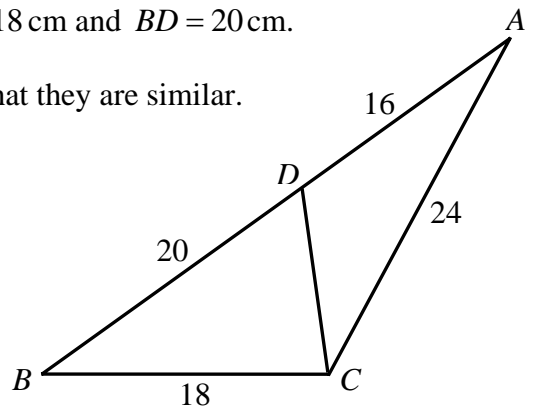
- (a) Express \overline{EC} in terms of \mathbf{a} and \mathbf{b} .
- (b) Find $|\overline{EC}|$.
- (c) Find $\frac{\text{area of triangle } ECD}{\text{area of triangle } ECB}$.
- (d) Find $\frac{\text{area of triangle } ECD}{\text{area of quadrilateral } ABDE}$.



Answer (a) $\overline{EC} = \dots\dots\dots$ [1]
 (b) $\dots\dots\dots$ units [1]
 (c) $\dots\dots\dots$ [1]
 (d) $\dots\dots\dots$ [1]

14 In the diagram, $AD = 16$ cm, $AC = 24$ cm, $BC = 18$ cm and $BD = 20$ cm.

- (a) Name a pair of similar triangles and show that they are similar.
- (b) Find the length of CD .



Answer (a) $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$ [2]

(b) $CD = \dots\dots\dots$ cm [2]

15 (a) Solve $-2 \leq \frac{2(3+7x)}{-7} < 12$.

(b) Write down the least and greatest integers which satisfy $-2 \leq \frac{2(3+7x)}{-7} < 12$.

Answer (a)..... [2]

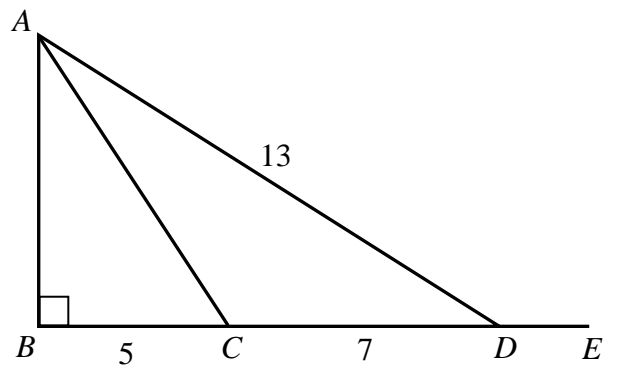
(b) Least integer = , greatest integer = [2]

16 In the diagram, angle $ABC = 90^\circ$, $AD = 13$ cm, $BC = 5$ cm and $CD = 7$ cm. Without using a calculator, find

(a) AC in the form of $a\sqrt{b}$, where a and b are constants,

(b) $\sin \angle ACD$,

(c) $\tan \angle ADE$.



Answer (a) cm [2]

(b)..... [1]

(c)..... [1]

- 17 The sum of two numbers is 28. $\frac{1}{6}$ of one of the numbers subtract $\frac{2}{7}$ of the other number is equal to 11. What are the two numbers?

Answer and [4]

- 18 The stem-and-leaf diagram represents the body temperature, in °C, of a group of students. Students with a body temperature of 37.6°C and above are considered to be unwell and have to report to the sick bay.

35	8								
36	9	8	9	4	8	8	6	7	
37	3	6	7	0	1	0			
38	2								

Key: 37 | 6 means 37.6

- (a) Find the mean body temperature.
- (b) Find the median temperature.
- (c) Find the mode of the distribution.
- (d) One student was selected at random from the group. Another student was selected at random from the remaining students. What is the probability that both of them need not report to the sick bay?

Answer (a) °C [1]

(b) °C [1]

(c) °C [1]

(d)..... [1]

19 The table shows a part of a pattern of numbers .

	A	B	Sum of digits in column B
Row 1	4^2	16	7
Row 2	34^2	1156	13
Row 3	334^2	111556	19
Row 4	3334^2	11115556	25
⋮	⋮	⋮	⋮
Row 6	w	x	y
⋮	⋮	⋮	⋮
Row n			z

- (a) Study the patterns in the table and write down the value of w , x and y for row 6.
 (b) Find, in terms of n , an expression for z .

Answer (a) $w = \dots\dots\dots$, $x = \dots\dots\dots$, $y = \dots\dots\dots$ [3]

(b) $z = \dots\dots\dots$ [1]

20 A group of 40 pupils raised funds for an organization and the amount they raised were shown in the table. Calculate

Amount raised (\$)	41 – 50	51 – 60	61 – 70	71 – 80
Number of Pupils	15	6	9	10

- (a) the mean,
 (b) standard deviation.

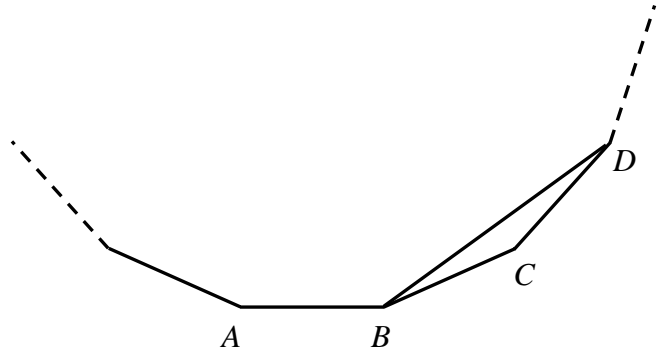
Answer (a)\$ $\dots\dots\dots$ [2]

(b)\$ $\dots\dots\dots$ [2]

21 The diagram shows part of a regular polygon with n sides. Each interior angle of the regular polygon is 162° . Find

(a) the value of n ,

(b) $\angle DBA$.

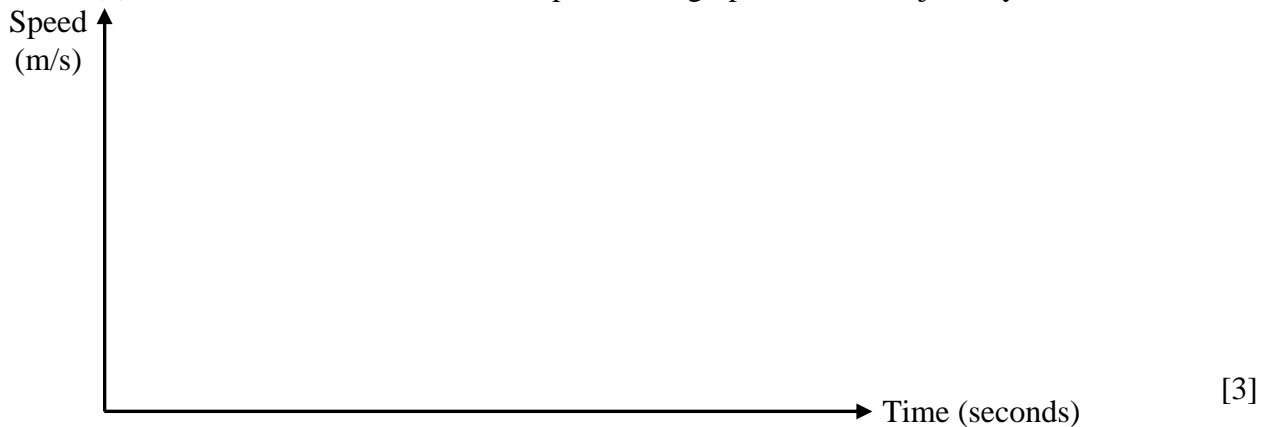


Answer (a) [2]

(b) $^\circ$ [2]

22 A car accelerated uniformly from rest at 3 m/s^2 for 8 seconds, after which it travelled at a constant speed for 20 seconds. The car then uniformly retarded at 4 m/s^2 until it finally reached a speed of 14 m/s .

(a) On the axes below, draw the speed-time graph of the car's journey.



(b) Find the total distance travelled by the car.

(c) Find the average speed of the car for the journey.

Answer (b)..... m [1]

(c)..... m/s [1]

- 23** (a) Construct a quadrilateral $ABCD$ such that $AB = 11\text{ cm}$, $AD = 7\text{ cm}$, $BC = 3.1\text{ cm}$, $\angle BAD = 60^\circ$ and $\angle ABC = 90^\circ$.
- (b) A line parallel to AC and passing through D meets BC produced at P . Draw this line and write down the length of CP .

Answer (a) & (b)

[3]

(b) cm [2]

- 24 (a) A line L passes through the point $A(-2, 2)$ and has gradient 2. Find the equation of L .
- (b) The point $B(2, a)$ lies on L . Find the value of a .
- (c) C is the point $(-4, 4)$. Given that $AB = \sqrt{p}$ cm, $AC = \sqrt{q}$ cm and $BC = \sqrt{r}$ cm, find the value of p , of q and of r .
- (d) What can you conclude about $\triangle ABC$? State your reason clearly.
- (e) Hence, find the area of $\triangle ABC$.

Answer (a)..... [2]

(b) $a =$ [1]

(c) $p =$, $q =$, $r =$ [3]

(d)

..... [1]

(e) cm^2 [1]

End of Paper

2009 Sec 4 E MATH Prelim 1 Paper 1

1		54 m/h
2		8 %
3		$\frac{98}{125}$
4		\$ 25 000
5		\$ 182.25
6	a	$2^2 \times 7^2 \times 11^2$
	b	154
7		12 mins
8		2.7513×10^3
9		$(180 - 2a - b)^\circ$
10		$\frac{2^3}{2^6}$
11		$\frac{3a^4}{16b}$
12	a	900 m
	b	25 cm^2
13	a	$a - b$
	b	4.12units
	c	$\frac{1}{3}$
	d	$\frac{1}{6}$
14	a	$\Delta DAC, \Delta CAB$ $\frac{DA}{CA} = \frac{AC}{AB} = \frac{2}{3}$
	b	12 cm
15	a	$-6\frac{3}{7} < x \leq \frac{4}{7}$
	b	-6, 0
16	a	$5\sqrt{2} \text{ cm}$
	b	$\frac{1}{\sqrt{2}}$
	c	$\frac{-5}{12}$
17		42 and -14

18	a	36.975° C
	b	36.9° C
	c	36.8° C
	d	$\frac{13}{20}$
19	a	$w = 333334^2, x = 111111555556$ $y = 37$
	b	$z = 6n + 1$
20	a	\$ 59
	b	\$ 12.16
21	a	20
	b	153°
22	b	623.5 m
	c	20.4 m/s
23	b	5 cm
24	a	$y = 2x + 6$
	b	$a = 10$
	c	$p = 80, q = 8, r = 72$
	d	ΔABC is a right-angled Δ $AB^2 = AC^2 + BC^2$
	e	12 cm^2

Paper 1 consists of **13** printed pages, including the cover page.

[Turn over