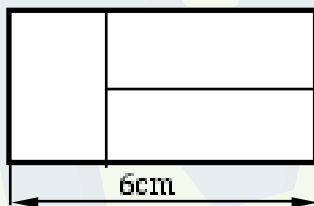


Elementary Questions

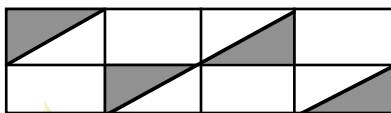
- 1 In a trip lasting 4 hours 20 minutes, a speedboat averaged 15 knots.
How many nautical miles was the trip? ... note : 1 knot = 1 nautical mile per hour.
- 2 Number plates in Snowland consist of three digits followed by one letter.
What is the maximum number of number plates available?
- 3 A father is five times as old as his son.
How many years ago was the son 2 years old and the father 34?
- 4 Dianne pays two fifths of her money on a T shirt, 30% on a pair of shorts and had \$15 left.
How much did she start with?
- 5 \$1200 is divided equally among four sisters so that each gets \$100 more than the sister who is the next younger sister. How much does the youngest sister get?
- 6 Find the greatest number that divides 364, 414 and 539 with the same remainder in each case?
- 7 A father is 37 years old and his son is 5 years old.
In how many years time will the father be three times as old as his son?



This rectangular shape can be cut into three identical rectangular shapes as shown.

If the length of the original rectangle is 6cm, find its width.

- 8
- 9 What is the units digit of 7^{20} , eg the units digit of $7^3 = 343$ is the last digit, 3
- 10 A shop buys shirts at \$20 each and sell them for \$25.
Express the profit as a percentage of the cost price.



What percentage of the the figure given is shaded?

- 12 The hour hand of a clock is pointing one third of the way between 1 and 2.
The minute hand should be pointing to which number on the face of the clock?
- 13 A boy sees the hands of a clock in the mirror, but he cannot see the numbers on the face of the clock. If the time appears to be 5:15, the time shown on the clock face is?
- 14 Five people at a party shook hands with each of the other 4 only once.
How many pairs of handshakes were there?

- 15** A restaurant has a total of 30 tables which are of two types. The first type seats two people at each table; the second type seats five people at each table. A total of 81 people are seated when all seats are occupied. How many tables for two are there?
- 16** Danielle was in a quiz where she received \$20 as starting money and received \$10 when she gave a correct answer and lost \$5 when she gave an incorrect answer. After answering 12 questions she had \$35. How many of the questions did she answer correctly?
- 17** If 5 teachers can mark 5 essays in 5 minutes, how long will it take 100 teachers to mark 100 essays (it is not 100 minutes)?
- 18** Ji Yun spends half of her pocket money on travel and each week she spends \$12 on food and snacks. This leaves her a third of her pocket money to make other purchases. Her weekly pocket money would be

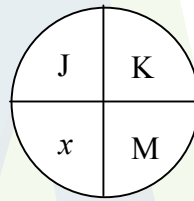
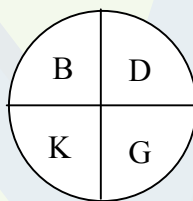
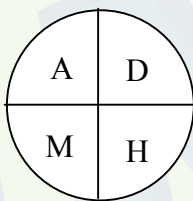
a \$24

b \$48

c \$72

d 36

- 19** Find the value x to complete



a O

b P

c Q

d R

- 20** Of the 35 vehicles in a car park, most are cars but some are motorbikes. There are 116 wheels on the vehicles. How many motorbikes are there in the car park?
- 21** “Imaging Electronics” is clearing all old stock TVs. Which of the following sale prices would result in the lowest price on a TV with a pre-sale price of \$1500?
- a** 20% discount on regular price **b** deposit of \$400 plus \$80/month for 1 year
c \$350 less than the regular price **d** $\frac{1}{6}$ reduction in the regular price

- 22** A boy has four boxes exactly the same. He finds that one box and half a brick weigh the same as a brick. The four boxes together would weigh as much as

a 1 brick

b 2 bricks

c 4 bricks

d 6bricks

- 23** What are the next two numbers in the sequence 0, 2, 6, 12, 20, 30, , ,

a 42 and 56

b 42 and 54

c 40 and 54

d 44 and 60

- 24** A jar filled with honey weighs 1kg. When the jar is half full the jar and honey weigh 650g. The total weight of honey in a full jar would be

a 500g

b 600g

c 650g

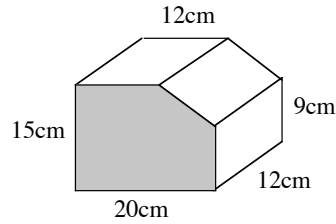
d 700g

- 25 Jai takes 3 hours to mow a lawn, whilst Theo takes 2 hours to mow the same lawn. If they both worked together, how long would it take to mow the lawn?
- a 1hr 12min b 1hr 15 min c 1 hr 30 min d 2 hr 30 min
- 26 Each of the dimensions of a rectangular box is increased by 100%. Then the volume of the box would have increased
- a two times b four times c six times d eight times
- 27 In a hockey tournament involving 6 teams, each team plays every other team twice. The total number of matches played is
- a 10 b 15 c 30 d 36
- 28 The pages of a book are number 1 to 150. The number of times the digit 0 will occur in the page number of the book is
- a 15 b 20 c 25 d 27
- 29 In her six yearly examinations Hitomi had an average score of 68%. However, a remark of her English paper gave her an extra 12% in that subject. Her new average mark would be
- a 80% b 70%
c 75% d cannot work out the new average from the information given
- 30 Brown's secret cake formula involved 4 cups of item A, 5 cups of item B, 3 cups of item C and 6 cups of the special ingredient D. It takes 54 cups to fill one drum. The number of cups of ingredient D to make 3 drums of cake formula is
- a 36 b 48 c 60 d none of these are correct
- 31 Andy McMath decided to replace the water in his swimming pool after draining and cleaning. He has access to a large hydrant, large tap and a garden hose. Used separately, the hydrant will take 18 hours, the tap takes 30 hours and the garden hose will take 45 hours if used separately. How long would it take Andy to fill the pool if he is able to use all three together?

Junior High School Questions

- 1 Sam had a book of raffle tickets. On Tuesday he sold 11 tickets to his family. On Wednesday he sold a third of the remaining tickets to his school friends. On Thursday he sold 4 tickets at Magic Club and his uncle then bought the remaining two. How many tickets were in the book to begin with?

- 2 Find the surface area and volume :



- 3 **Percentages :** a 10% of \$483 b 2% of \$3140 c 99% of \$49
d $\frac{1}{2}\%$ of \$600 e 25% of 8424 kg f 75% of 12000 km

- 4 **Equations :** a $1 \cdot 2x + 0 \cdot 35x = 31$ b $2 \cdot 4(10x + 5) = 33$
c $\frac{x - 1 \cdot 7}{7 \cdot 4} = 0 \cdot 3$ d $37\% \text{ of } x = 7 \cdot 4$

- 5 The hot tap fills the bath in 18 minutes
The cold tap fills the bath in 10 minutes
How long will it take to fill the bath using both taps?

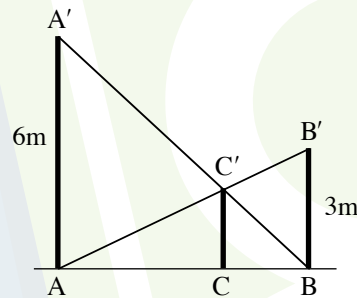
- 6 **Similar Triangles :**

Two poles AA' and BB' are standing vertically to the ground.

AA' and BB' are 6 m long and 3 m long respectively.

We stretched two wires AB' and BA' , and set up the pole CC' .

Find the height of the point C' .



- 7 $a : b : c = 8 : 11 : 15$ $2a - b = 30$ Find a, b, c

- 8 Find the selling price of a TV bought for \$899 and sold at a profit of : a 18% of the cost price
b 21% of the selling price

- 9 Four carpenters can nail four wall boards in four minutes. How long would it take twelve carpenters to nail 500 wall-boards?

- 10 There are 14 teams in the district netball competition, every team has on match every Saturday, and each team plays every other team twice.

- a How many Saturdays are needed to complete the competition?
b How many games are there played during the competition?

- 11 A, B, and C all work on a project. A is twice as quick as B and B is 25% quicker than C. If A alone can complete the project in 24 hours, how long will it take

- a B alone? b C alone? c A, B, & C all working together?

- 12 Algebra ... factorise : a $27a^2m - 36a^3m^2$ b $40m^3n^5 + 24m^2n^7$

13 Suzie sets out to drive across the Nullabour Plain. The total trip on the first day is to be 800 km. For the first 3 hours Suzanne averages 80 km per hour. How fast must she drive for the rest of the trip if she wishes to average 100 km per hour for the whole trip?

14 John, who is less than 20 years old, is 7 years older than Mai, but only half the age of Tung. In 7 more years the sum of John and Mai's ages will equal Tung's age. How old are John and Mai now?

15 Equations ... solve these equations:

a $5 - \frac{m}{3} = -2$

b $\frac{3+m}{5} - \frac{(m-2)}{2} = 1$

c $\begin{cases} 7x + 3y = 16 \\ -2x + y = 1 \end{cases}$

16 Alan had a book of raffle tickets. On Tuesday he sold 16 tickets to his family. On Wednesday he sold half of the remaining tickets to his school friends. On Thursday he sold 8 tickets at swim training and his father then bought the remaining two. How many tickets were in the book to start with?

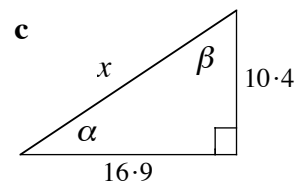
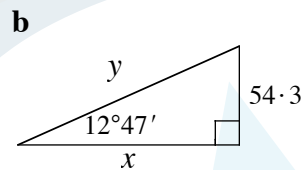
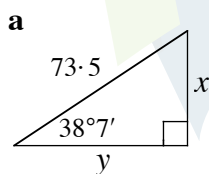
17 N is a 5-digit number 8A65B in which A and B are digits, and N is divisible by 24. What is the smallest number N can be?

18 Simplify: **a** $\frac{2x}{5} + \frac{3x}{4}$ **b** $\frac{3x}{5y} \times \frac{y^2}{6x}$ **c** $\frac{3}{2a} + \frac{4}{a-1}$

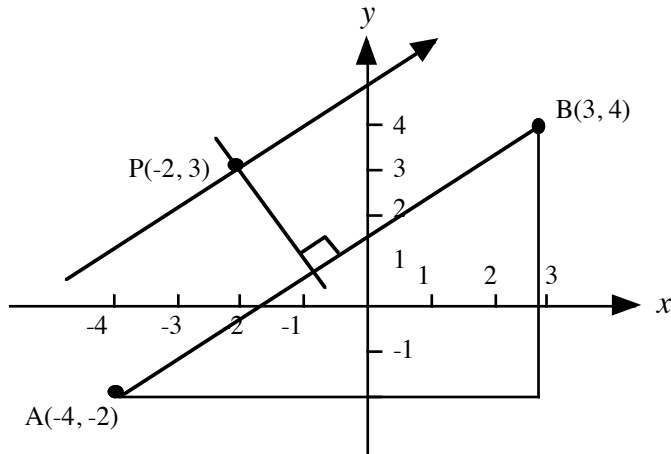
19 Draw a Venn Diagram to show that when 45 people were surveyed, 25 had seen 'Hairy Potts', 29 had seen 'Start Where?' and 18 had seen 'Teenage Equation Solvers'.
Eighteen people had seen both 'Hairy Potts' and 'Start Where?'
Nine people had seen both 'Hairy Potts' and 'Teenage Equation Solvers'.
Seven people had seen both 'Start Where?' and 'Teenage Equation Solvers'.
Three people had seen all three movies.

Question : How many had seen none?

20 Use trigonometry to solve the three triangles

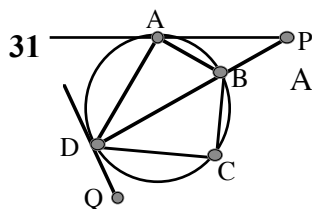


21 Area : Heidi the goat is tethered on a 7m rope to the corner of a 6m by 5m rectangular shed. What is the area of the grass that Heidi can reach? ... a diagram is a good start ...



- Find: **a** Length **b** Slope **c** Equation **d** Mid-point of AB
e Find the equation of the line through $P(-2, 3) \parallel AB$
f Find the equation of the line through $P(-2, 3) \perp AB$
g Find area Triangle APB

- 23** Geometry: ABCDE is a pentagon with all its sides equal and all its angles equal.
 Join AC, AD.
 Prove that $AC = AD$ and $\angle ACD = \angle ADC$
- 24** T and V in the four-digit number T37V represent different digits, and T37V is divisible by 88 without a remainder. Find the digits T and V
- 25** When 6 is placed at the right hand of a two digit number, the value of the newly formed three digit number is 294 more than the value of the original two digit number. Find the original two digit number.
- 26** A ship leaves a port on a bearing of $310^\circ T$ and travels 60 n. miles.
 It then changes course to $220^\circ T$ and travels a further distance.
 If it is now 85 n. miles from the port, how far did the ship travel on its second leg?
- 27** Factorise completely: **a** $3p^2 - 35p + 22$ **b** $2a^2 - 5a - 3$ **c** $12x^2 + 16x - 3$
- 28** Solve using the factor theorem or otherwise
- a** $8x^6 + 7x^3 - 1 = 0$ **b** $(x^2 + 6x)^2 + 17(x^2 + 6x) + 72 = 0$ **c** $x^2 + x + \frac{24}{x^2 + x} = 14$
- 29** A team of fifty shearers is hired to shear twenty thousand (20 000) sheep. The total job will take sixty (60) days. After twenty days 15 shearers leave and are not replaced. How many more days are now needed (immediately after the 15 have left) to complete the job?
- 30** From a point A, one ship sails on a bearing of 57° for 19 km. From the same point, A, another ship sails on a bearing of 136° for 25 km. How far apart are they?



AP, DQ are tangents and BD is a diameter.
 $\angle BAP = x^\circ$ and $\angle BPA = y^\circ$,
 find a relationship between x and y

Senior High School Questions

1 Factorise **a** $12x^2 + 16x - 3$ **b** $12y^2 - 11y - 36$ **c** $a^2 - 2ab + b^2 - c^2$

2 Solve: **a** $\begin{cases} y = 5x - 7 \\ 4x - 2y + 4 = 0 \end{cases}$ **b** $\begin{cases} 2x + 3y + z = 5 \\ x - 4y - 2z = 11 \\ 5x + y - 7z = 16 \end{cases}$

3 Solve the inequalities

a $|5y + 2| - 4 < 18$ **b** $\frac{4}{y-3} \geq y$ **c** $\frac{5}{y+2} + \frac{4}{y-1} \leq 3$

4 Solve for $0 \leq x \leq 360$:

a $\sec x = 4 \cos x$ **b** $2 \cos^2 x - 3 \sin x = 0$ **c** $\sin^2 x - 3 \sin x \cos x + 2 \cos^2 x = 0$

5 Find the co-ordinates of P(x, y) which divide A(-5, 2) to B(10, -8) in the ratio of 3:5

a internally **b** externally

6 Sketch the curves & state domain and range

a $y = |2x - 8|$ **b** $y = \frac{1}{|x-2|}$ **c** $|2x + 3y| = 6$

7 Find "a" and "b" as rational numbers if: **a** $(5\sqrt{2} - 3)^2 = a + b\sqrt{2}$ **b** $\frac{2\sqrt{7} + 1}{3\sqrt{7} + 2} = a + b\sqrt{7}$

8 Simplify the algebraic fractions: **a** $\frac{5m}{m-2} + \frac{10}{2-m}$ **b** $\frac{3x}{x^2 - x - 12} \times \frac{x^2 + x - 6}{4x^2}$

9 If $x = 3 + \sqrt{8}$ evaluate (a) $x^2 - \frac{1}{x^2}$ and (b) $x^2 + \frac{1}{x^2}$

10 Sketch the curves: **a** $|xy| = 2$ **b** $y = \frac{2}{(x-2)(x+1)}$ **c** $f(x) = \begin{cases} 2-x & : x < -2 \\ x^2 - 4 & : -2 \leq x \leq 2 \\ 2x - 4 & : x > 2 \end{cases}$

11 Solve the simultaneous equations: **a**
$$\left. \begin{aligned} y &= x^2 + 2x + 2 \\ y &= 5x + 12 \end{aligned} \right\}$$
 b
$$\left. \begin{aligned} y &= x^2 - 2x + 3 \\ y &= 3x - 9 \end{aligned} \right\}$$

12 If $3x^2 - 2x + 5 = 0$ has roots α, β

Write down the value of **a** $\alpha + \beta$ **b** $\alpha\beta$ **c** $\alpha^2 + \beta^2$ **d** $\frac{1}{\alpha} + \frac{1}{\beta}$ **e** $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

13 Find the following limits : **a**
$$\lim_{x \rightarrow \infty} \frac{4x^2 - 13x - 104^2}{x^2 + 5}$$
 b
$$\lim_{x \rightarrow -2} \frac{\sqrt{x^3 - 6x + 5} - 3}{x^3 - 6x - 4}$$
 c
$$\lim_{h \rightarrow 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$$

14 In any triangle ABC prove that :
$$\cot B = \frac{a - b \cos C}{b \sin C}$$

15 Given: $R(u) = \frac{3u-1}{4u+2}$ prove that: $R\left(\frac{u-1}{u+2}\right) = \frac{2u-5}{6u}$

16 ABCDEF is a polygon in which $AB = BC = 2$ units, $CD = DE = 3$ units, and $EF = FA = 4$ units. $\angle ACB = \angle DEC = \angle FAE = 30^\circ$. Prove that the area of this polygon is approximately 21.3 square units.

17 Sketch the following curves and write down the domain and range:

a $\frac{1}{x} + \frac{1}{y} = 4$ **b** $|x| + |y| = 6$ **c** $y = 2^x - 1$

18 **a** Find the ratio that the point $P(3, k)$ divides the interval joining $A(-6, 5)$ to $B(7, 26)$ given that A, B and P are collinear.
b Find the value of k .

19 Differentiate w.r.t. x **a** $12x^2\sqrt{x}$ **b** $\frac{10}{3x^2\sqrt{x}}$ **c** $\sqrt{2x} + \frac{7}{2\sqrt{x}}$

20 Trigonometric Identities, prove that

a
$$\frac{1 - \sin \theta + \cos \theta}{1 - \sin \theta} \equiv \frac{1 + \sin \theta + \cos \theta}{\cos \theta}$$
 b
$$\frac{1 + \cos \theta}{1 - \cos \theta} + \frac{1 - \cos \theta}{1 + \cos \theta} \equiv 2(1 + 2 \cot^2 \theta)$$

c
$$\sin^2 \theta \cdot \tan \theta + \cos^2 \theta \cdot \cot \theta + 2 \sin \theta \cdot \cos \theta \equiv \tan \theta + \cot \theta$$

21 A tower stands on a horizontal plane.

At a point A $S 20^\circ W$ of the tower, the angle of elevation of the top of the tower is 52° .

At a point B $S 40^\circ E$ of the base of the tower, the angle of elevation of the top of the tower is 45° . A and B are 80m apart. Find the height of the tower

22 Sketch the curves: (a) $y = x^3 - 3x^2 - 9x + 20$ and (b) $y = x^3 - 3x^2 - 12$

23 Shade in the regions:

a $y \geq 2^x \cap y \leq 4 - x^2$ **b** $y \geq 3^x - 1 \cap x + y \leq 5 \cap x \geq 1 \cap y \geq -2$

c $y \leq |x - 2| + 3 \cap x + y \geq 0 \cap y < 4$



Elementary Answers

- 1** 65 nm **2** 26000 **3** 6 years ago
4 \$50 **5** \$150
6 25 being the largest factor of the differences which are 50, 125 and 175
7 11 years **8** Width of original rectangle = 4cm
9 1
10 25% **11** 25% **12** 4
13 6:45 **14** 10 handshakes
15 23 Tables have two people, 7 tables have 5 people.
16 Danielle answered 5 questions correctly. **17** 5 minutes
18 **c** \$72 **19** **b** P **20** **d** 12
21 **c** \$350 less than the regular price **22** **b** 2 bricks
23 **a** 42 and 56 **24** **d** 700g **25** **a** 1hr 12min
26 **d** eight times **27** **c** 30 **28** **c** 25
29 **b** 70% **30** **d** none of these are correct **31** 9 hours

Junior High School Answers

- 1** There were 20 tickets originally
2 Vol = 3312 cm³
 SA = 1344 cm²
3 Percentages: **a** \$48.30 **b** \$62.80 **c** \$62.80
 d \$3 **e** 2106 kg **f** 9000 km
4 Equations: **a** $x = 20$ **b** $x = \frac{7}{8}$ **c** $x = 3.92$ **d** $x = 20$
5 $6\frac{3}{7}$ minutes
6 Similar Triangles: 2m **7** $a = 48, b = 66, c = 90$

7 **a** \$1060.82 SP CP P
 b \$1137.40 118 100 18%
 x 899

8 $4 \times 41\frac{2}{3} \text{ min} = 166\frac{2}{3} \text{ minutes}$

10 **a** 26 **b** 182

11 **a** 48 hours **b** 60 hours **c** 12 hours 38 minutes

12 Factorised : **a** $9a^2m(3-4am)$ **b** $8m^2n^5(5m+3n^2)$

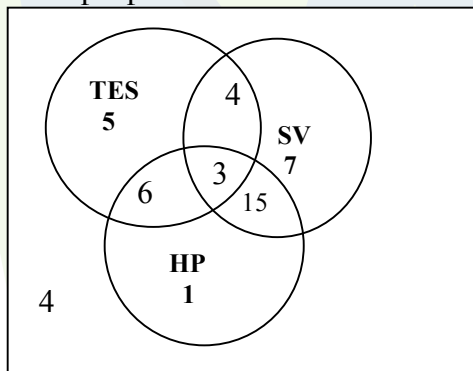
13 112 km/hr for Suzie 14 John is 15 and Mai is 8 years old

15 **a** $m = 21$ **b** $m = 2$ **c** $x = 1, y = 3$

16 Alan began with 36 tickets 17 82656

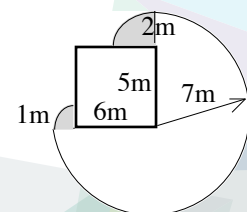
18 **a** $\frac{23x}{20}$ **b** $\frac{y}{10}$ **c** $\frac{11a-3}{2a(a-1)}$

19 4 people had seen none



20 Trigonometry: **a** $x = 45 \cdot 4$ **b** $x = 293 \cdot 3$ **c** $x = 19 \cdot 8$
 $y = 57 \cdot 8$ $y = 245 \cdot 41$ $\alpha = 31^\circ 36'$
 $\beta = 58^\circ 24'$

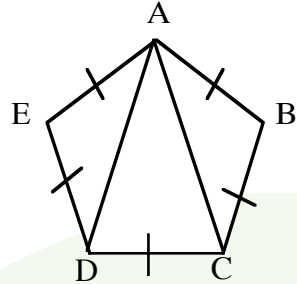
21 Heidi's area = $\frac{3}{4}$ of $\pi \cdot (7\text{m})^2 + \frac{1}{4}$ of $\pi \cdot (2\text{m})^2 + \frac{1}{4}$ of $\pi \cdot (1\text{m})^2$
 $= 38\pi\text{m}^2$
 $\approx 119 \cdot 38\text{m}^2$



22 **a** $AB = \sqrt{85}$ **b** $\text{grad } AB = \frac{6}{7}$ **c** $7y = 6x + 10$ **d** $\text{Mid-pt } AB \equiv (-0.5, 1)$

- $l \parallel AB \quad \therefore \quad 7y = 6x + k$
e but thru P(-2, 3) so $7 \times 3 = 6 \times -2 + k$
 hence $7y = 6x + 33$
 $l \perp AB \quad \therefore \quad 6y = -7x + c$
f but thru P(-2, 3) so $6 \times 3 = -7 \times -2 + c$ **g** Area $\Delta APB = 11.5u^2$
 hence $6y = -7x + 4$

23 Geometry



$AC = AD$ (Cong Δ 's SAS)
 $\angle ACD = \angle ADC$ base \angle 's of isosceles triangle

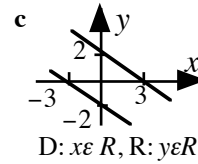
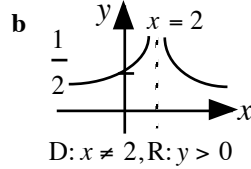
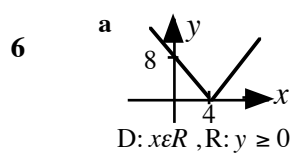
- 24** $T = 2, V = 6$ **25** $A = 3, B = 2$
26 2^{nd} Leg = 60.21nm
27 **a** $(3p-2)(p-11)$ **b** $(2a+1)(a-3)$ **c** $(6x-1)(2x+3)$
28 **a** $x = \frac{1}{2}$ or -1 **b** $x = -3, -3, -4$ or -2 **c** $x = 1, -2, 3$ or -4
29 It takes $57\frac{1}{7}$ days
30 28.37km apart
31 $2x + y = 90^\circ$ Need not use point C in solution

Senior High School Answers

- 1** **a** $(6x-1)(2x+3)$ **b** $(4y-9)(3y+4)$ **c** $(a-b-c)(a-b+c)$
2 **a** (3, 8) **b** (5, -2, 1) ie $x = 5, y = -2, z = 1$
3 **a** $0 < x \leq 3$ **b** $y \leq -1$ or $3 < y \leq 4$ **c** $y < -2$ or $-1 \leq y < 1$ or $y \geq 3$
4 **a** $\Rightarrow \cos^2 x = \frac{1}{4} \quad \therefore x = 60^\circ, 120^\circ, 240^\circ, 300^\circ$
 b $\Rightarrow \sin x = \frac{-3 + \sqrt{17}}{2} \quad \therefore x = 34^\circ 10', 145^\circ 50'$

c $\Rightarrow \tan^2 x - 3\tan x + 2 = 0 \quad \therefore x = 63 \cdot 4^\circ, 243 \cdot 4^\circ, 45^\circ, 225^\circ$

5 a $\left(\frac{5}{8}, -\frac{14}{8}\right)$ b $\left(-27\frac{1}{2}, 17\right)$

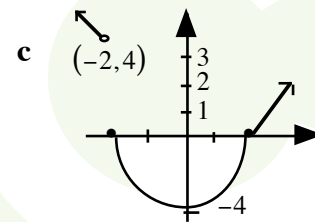
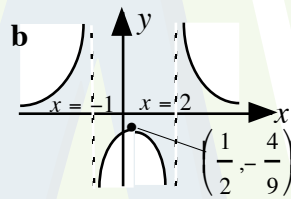
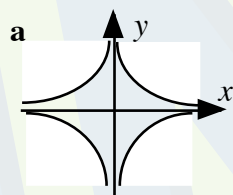


7 a $a = 59, b = -30$ b $a = \frac{40}{59}, b = -\frac{1}{59}$

8 a 5 b $\frac{3(x-2)}{4x(x-4)}$

9 a $24\sqrt{2}$ b 34

10

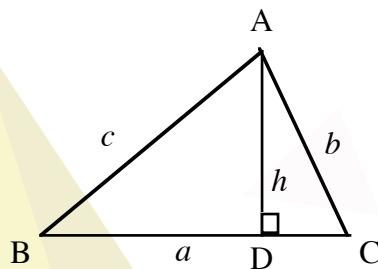


11 a $(-2, 2)$ and $(5, 37)$ b No solution, line does not intersect parabola

12 a $\alpha + \beta = \frac{2}{3}$ b $\alpha\beta = \frac{5}{3}$ c $\alpha^2 + \beta^2 = -2\frac{8}{9}$ d $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{2}{5}$
e $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = -1\frac{11}{15}$

13 a 4 b $\frac{1}{6}$ c $\frac{1}{2\sqrt{x}}$

14



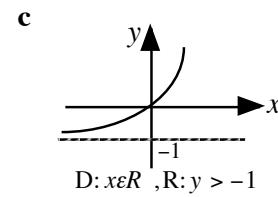
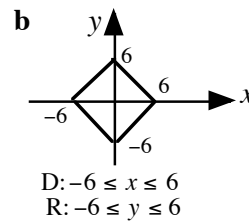
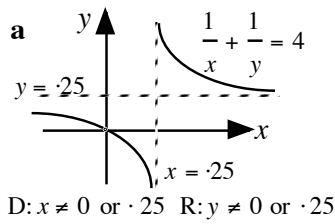
$$\cot B = \frac{h}{BD}$$

$$\begin{aligned} BD &= BC - DC \\ &= a - b\cos C \\ h &= b\sin C \end{aligned}$$

$$\therefore \cot B = \frac{a - b\cos C}{b\sin C}$$

15 Proof 16 Proof

17



18 **a** 9 : 4 **b** $k = 19\frac{7}{13}$

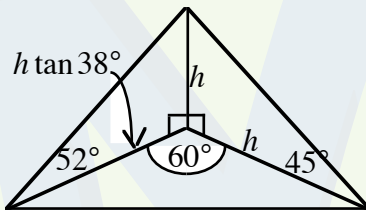
19 **a** $30x\sqrt{x}$

b $-\frac{25}{3x^3\sqrt{x}}$

c $\frac{1}{\sqrt{2x}} - \frac{7}{4x\sqrt{x}}$

20 Proofs: use $\sin\theta = y$; $\cos\theta = x$; $x^2 + y^2 = 1$

21 $h = 87 \cdot 9$ From $80^2 = h^2 \tan^2 38^\circ + h^2 - 2 \times h \times h \cdot \tan 38^\circ \times \cos 60^\circ$



22 **a** max(-1, 25) min(3, -7) inflex(1, 9) intercept(0, 20)

b max(0, -12) min(2, -16) Inflex(1, -14) y - intercept(0, -12)

Note: Cannot find x intercepts, and for cubic equations, the inflection points are always the mid-point of the line joining the two turning points.

23

