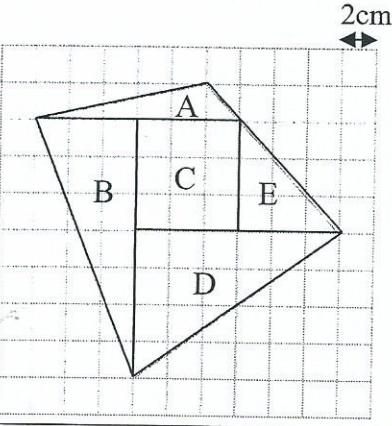
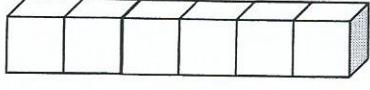


**10 × 10
AIM FOR
TOP SELECTIVE HIGH SCHOOLS**

**MATHEMATICS
ANSWERS & EXPLANATIONS**

Test 01

Question Number	Answer	Solution
1	A	\$131.43. 2.5% of \$134.80 = $0.025 \times 134.80 = \$3.37$ Therefore, $\$134.80 - \$3.37 = \$131.43$
2	D	 Area of A = $0.5 \times 12 \times 2 = 12$ Area of B = $0.5 \times 6 \times 14 = 42$ Area of C = $6 \times 6 = 36$ Area of D = $0.5 \times 8 \times 12 = 48$ Area of E = $0.5 \times 6 \times 6 = 18$ Area A + B + C + D + E = 156 cm^2
3	A	Rectangle 1 First of all we need to find shaded fractional part for each rectangle: Rectangle 1: $\frac{8}{15}$; Rectangle 2: $\frac{7}{15}$; Rectangle 3: $\frac{6}{15}$; Rectangle 4: $\frac{10}{15}$. The decimal 0.533 is bit more than one half. Therefore, only Rectangle 1 satisfies these conditions.
4	C	6 men → 5 hours → 2 metres 1 man → 30 hours → 2 metres 1 man → 15 hours → 1 metre 5 men → 3 hours → 1 metre
5	C	 $6 \times 4 = 24$ $1 \times 2 = 2$ So total SA = 26 cm^2
6	C	$2 + 12 + 20 + \dots + 32 + 42 + 52 + 62 + 72 + 82 + 92 = 693$
7	D	If a small cube has dimensions $2 \text{ cm} \times 2 \text{ cm}$, the area of one small face = 4 cm^2 . There are 9 small faces on one face of the cube and 6 faces. Therefore the surface area is given by $4 \text{ cm}^2 \times 9 \times 6 = 216 \text{ cm}^2$. When the corners are removed, the surface area will remain unchanged. Hence the surface area is still 216 cm^2 .

8	D	1997 all other years are leap years (years divisible by 4) with 29 days in February.
9	A.	$0.8 \times 30 = 24$ L. Emily spends \$1/L $0.3 \times 30 = 9$ L. Josephina spends $9.9 \div 9 = \$1.10$ /L Therefore, Emily spends \$0.10 less per litre.
10	C	Refer to diagram.

Test 02

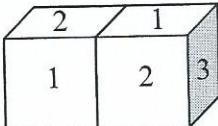
Question Number	Answer	Solution
1	D	$21 \text{ m} \div 3 = 7$ with an additional mango tree at the end of the row = 8 mango trees per row $56 \div 8 = 7$ rows
2	A	Gina is $0.5 \text{ kg} + \text{Jo}$ ∴ Gina = 6.8 kg Jo = 6.3 kg If Jo is 6.3 kg, then Kim = $11.2 - 6.3 = 4.9$ kg If Kim is 4.9 kg, then Pat = $12.5 - 4.9 = 7.6$ kg
3	C	$4D + 2B = 170$ (1) $2B = D$ (2) Substitute (2) into (1): $4 \times 2B + 2B = 170$ $10B = 170$ $B = 17$
4	B	25% off \$95 is \$71.25 40% off \$120 is \$72 $72 + 71.25 = \$143.25$ ∴ change is $150 - 143.25 = \$6.75$
5	C	40 5 people, 32 days, 1 house 1 person, 160 days, 1 house 8 people, 20 days, 1 house 8 people, 40 days, 2 houses
6	D	1352 $11 \bullet 2 = 8 \times (11 + 2)^2$ $= 8 \times 13^2$ $= 8 \times 169 = 1352$
7	C	$\frac{22}{32} - \frac{1}{8} = \frac{11}{16} - \frac{2}{16} = \frac{9}{16}$ $\sqrt{\frac{9}{16}} = \frac{3}{4} = 0.75$
8	C	Each number is a square number + 1. 9 should be replaced with 10.
9	C	Tap A fills 6 L/min, Tap B fills 4 L/min. Together they fill 10 L/min, so it takes them 6 minutes to fill 60 L.
10	D	$(\text{Length} - 5 \text{ cm}) \div 3 + 1 = \text{number of shapes}$ $200 - 5 = 195; 195 \div 3 = 65; 65 + 1 = 66$ shapes

Test 03

Question Number	Answer	Solution
1	A	<p>$\\$18.10 - \\$12.30 = \\$5.80$ = difference of 2 kg onions So 1 kg onion = $\\$5.80 \div 2 = \\2.90 Therefore $\\$2.90 \times 3 \text{ kg} = \\8.70 for 3 kg onions $\\$12.30 - \\$8.70 = 2 \text{ kg carrots} = \\3.60 1 kg carrots = \$1.80</p>
2	A	<p>How she paid: $\\$500 \times 0.8 = \\400 $\\$400 \times 0.9 = \\360 Her friend's suggestion: $\\$500 \times 0.7 = \\350 Therefore, her friend was right. She would have saved \$10.</p>
3	C	<p>5.</p>
4	D	<p>$\text{Circumference} = \pi D$ Total circumference = $\pi \times 7 + \pi \times 14 + \pi \times 21$ $\pi \times 42 = \frac{22}{7} \times 42 = 132 \text{ cm}$</p>
5	C	<p>12:01 am</p> <p>Freezing point = 0°C, so takes 12 hours. So, at 12 am, temperature is 0°C At 12:01 am, temperature is below 0°C</p>
6	C	<p>Using Pythagoras' Theorem</p> $4^2 + 3^2 = 25$ $5^2 = 25$
7	D	<p>43%</p> $\frac{129}{300} = \frac{43}{100} = 43\%$
8	D	<p>Train travels at 180 km/hr. It takes 20 min to travel 60 km and 10 min to travel 30 km.</p>

		<p>3.25 hours = 3 hrs and 15 min. Homebush → Central = 30 min + 5 min waiting time. Central → Homebush = 30 min + 5 min waiting time.</p> <p>Total time consumed = 4 hrs 25 min. 8:45 am + 4 hrs 25min = 1:10 pm</p>
9	D	20 + 2 = 22 minutes.
10	C	In a net of a pentagonal prism, there are two pentagons and five rectangles. Therefore, $(2 \times 5) + (5 \times 4) = 10 + 20 = 30$

Test 04

Question Number	Answer	Solution
1	A	Trial and error starting from the least number of different colours. E.g. 
2	A	Egg 1: 50g Egg 2: 54g Egg 3: 58g... Egg 5: 66g
3	D.	$150 \times 13 \times 14 + 50 \times 24 \times 2 = 29\ 700\text{km}$.
4	A	Trial-and-error: In 12 minutes: Matilda's father = $\frac{12}{20} = \frac{3}{5}$ of the lawn cut Matilda = $\frac{12}{30} = \frac{2}{5}$ of the lawn cut $\frac{2}{5} + \frac{3}{5} = 1$ complete lawn cut
5	B	Large circle = $\pi \times 14^2$ Small circle = $\pi \times 7^2$ $\frac{\text{Small circle}}{\text{Large circle}} = \frac{7^2}{14^2} = \frac{1}{4}$
6	B	5 km/h From 6 – 12, Tim walked 30 km. $30 \div 6 = 5$ km/h From 12 – 6, Tim walked 60 km. $60 \div 6 = 10$ km/h So, difference is 5 km/h.
7	C.	Carrie made a call over the shortest distance. i.e. Carrie made the shortest distance calls as it cost the least and she spoke for the longest time.
8	D	Tap A = $3\text{L}/10\text{s} = 0.3\text{L/s}$ Tap B = $4\text{L}/8\text{s} = 0.5\text{L/s}$ Tap A + Tap B = 0.8L/s So the rate for both taps is 0.8L/s . $\frac{1000}{0.8} = 1250\text{s}$ 1250s = 20min 50secs

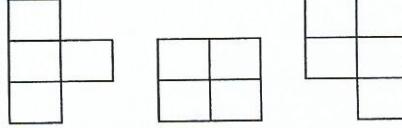
9	D	<p>Each 1 hour interval on a clock is 30°. At 6.20, the minute hand is on the 4 and the hour hand is at $\frac{1}{3}$ of the way past the 6 (10°). The acute angle between the two hands is 70°.</p> <p>Reflex angle = $360^\circ - 70^\circ$</p> <p>Reflex angle = 290°</p>
10	D	<p>Volume of the bottle: $3^2 \times \pi \times 9 = 81\pi$</p> <p>Volume of the neck: $\pi r^2 \times h = \pi \times 1^2 \times 8 = 8\pi$</p> <p>Volume of vinegar in main body when bottle is upside down: $81\pi - 8\pi = 73\pi$ $73 \times 3.14 = 229.22\text{cm}^3$</p>

Test 05

Question Number	Answer	Solution
1	A	The structure has an empty space of 4 cubes. Each cube has a volume of $2 \times 2 \times 2 = 8 \text{ mL}$. $4 \times 8 \text{ mL} = 32 \text{ mL}$.
2	D	\$950 000
3	B	66% Class A: $60 \times 24 = 1440$ Class B: $70 \times 32 = 2240$ \nearrow add to 3680 So, average of both A & B = $3680 \div (24 + 32) = 65.7\%$
4	D	1^{st} diagram = $8 \times 6 \times 6 = 288 \text{ cm}^3$ 2^{nd} diagram = $5 \times 6 \times 6 + \text{top of carton} = 180 + \text{top of carton}$ The same amount of milk is in both cartons. $288 \text{ cm}^3 = 180 + \text{top}$ Top = 108 cm^3 The rest of the carton's volume = $10 \times 6 \times 6 = 360 \text{ cm}^3$ Total volume = $360 + 108 = 468 \text{ cm}^3$.
5	D.	$(1^{\text{st}} \text{ number} - 3^{\text{rd}} \text{ number})^3 = 2^{\text{nd}} \text{ number}$. $(9 - 4)^3 = 5^3 = 125$
6	D	\$4 800 = 120% \$400 = 10% Original price = \$4 000 $\$4 000 \times 1.75 = \$7 000$
7	A	\$5687.50 Interest rate increase = $5\% - 3.25\% = 1.75\%$ So interest increase = $\$325 000 \times \frac{1.75}{100} = \$3 250 \times 1.75 = \$5 687.50$
8	D	$20\% \times 3750 = \$750$ $10\% \times 2234 = \$223.40$ $15\% \times 4420 = \$663$ $10\% \times 3879 = \$387.90$ Total = \$2 024.30
9	B	2 paintings = \$4 800, commission = 6% Therefore, artist receives 94%. $0.94 \times 4800 = \$4 512$
10	B	40

		$\frac{1}{2} \times \frac{1}{5} = \frac{1}{10}$ died and $\frac{9}{10}$ survived 180 survived so there was a total of 200. $\frac{1}{5} \times 200 = 40$ got the disease
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Test 06

Question Number	Answer	Solution
1	B	$\frac{1}{2} \times 5 \times 4^2 = 40$
2	A	Unlabelled angle = $360^\circ - (a + b + c)$ $x = 360 - [360 - (a + b + c)]$ $x = a + b + c$
3	C	Probability: H1 H2 H3 H4 H5 <u>H6</u> T1 T2 <u>T3</u> T4 T5 T6
4	D	The key point to pick up is that 4 types are used at the same time. This means that the 5 tyres are 'rested' equally. $40\ 000 \text{ km} \div 5 = 8\ 000 \text{ km}$ So each tyre rests for 8 000 km. $40\ 000 \text{ km} - 8000 \text{ km} = 32\ 000 \text{ km}$ So every tyre travels 32 000 km. The spare tyre takes turns replacing the other 4 tyres, 8000 km at a time: $8000 \times 4 = 32000 \text{ km}$.
5	D	At A the water temperature is beginning to increase from boiling point, and turns into steam. Therefore the liquid is turning into a gas.
6	B	3 other tetrominos can be made. 
7	C	Trial and error: start off with the smallest option, i.e. option A. Let: $\frac{N}{18} = 2$ $N = 36$ (which is a square number and has 18 as a factor) The correct answer is option A.
8	A	Production increased by $y\%$ on top of x amount of computers. $x + y\% \times x = x + \frac{xy}{100} = x(1 + \frac{y}{100})$
9	C	The number of counters in each additional hexagon increases by increments of 6. Therefore in Figure 6 there will be 36 counters. The number of counters on each side increase by 1 with each additional figure. It started off with 2 on each side. Therefore by figure 6 there will be 7 counters on each side.
10	D	$5\ddot{\cup} = (5 \times 1) + (4 \times 2) + 3$ $6\ddot{\cup} = (6 \times 1) + (5 \times 2) + (4 \times 3)$ $10\ddot{\cup} = (10 \times 1) + (9 \times 2) + (8 \times 3) + (7 \times 4) + (6 \times 5) = 110$ Each contain the numbers up to the number before the $\ddot{\cup}$.

Test 07

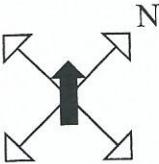
Question Number	Answer	Solution
1	B	\$13.50 + \$36.50 + \$143 + \$1.00 + \$1.50 = \$195.50 Rounded to the nearest dollar = \$196
2	B	1, 6, 12, 18..... Each ring after the first has $(r - 1) \times 6$ hexagons. 9 th ring has $(9 - 1) \times 6 = 8 \times 6 = 48$ hexagons.
3	A	$\$325 \times 40\% = 130$ $325 + 130 = \$455$ $\$455 + \40 (listing fee) = $\$495$
4	A	A: \$10.40/kg B: \$12.40/kg C: \$12.40/kg D: \$12.00/kg
5	D	$\text{Ann} = 85 \times \frac{12}{100} \times \frac{8}{12} = \6.80 $\text{Michael} = 85 \times \frac{10}{100} \times \frac{6}{12} = \4.25 Ann receives more = $\$6.80 - \$4.25 = \$2.55$
6	D	$\frac{2\pi r}{2} = \frac{\pi r}{1}$ Since $\pi = \frac{22}{7}$, $\pi r = \frac{22}{7} \times 7 \text{ cm} = 22 \text{ cm}$ Since all the sides of the two squares should be 7 cm each, Perimeter = 22 cm + 7 cm + 7 cm + 7 cm + 7 cm = 50 cm .
7	A	$\frac{1}{3}$ $108 - 72 = 36$ $\frac{36}{108} = \frac{1}{3}$
8	B	76 kg $\text{Total weight} = (10 \times 80) + (8 \times 70) = 800 + 560$ $= 1360 \text{ kg}$ So, average = $1360 \div 18 = 75.6$ $\approx 76 \text{ kg}$
9	D	55 km In 20 minutes, the car travelling at 75 km/hr travels 25 km. In the same time, the car travelling at 90 km/hr travels 30 kms. Thus, 20 minutes before they pass each other, they would be $30 + 25 = 55$ km apart.
10	C	3 mins To pass the tunnel completely, the train must travel 3.5 km. To travel 3.5 km, the train will take $\frac{3.5}{70} \times 60 \text{ min} = 3 \text{ min.}$

Test 08

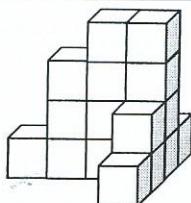
Question Number	Answer	Solution
1	C	Today is Thursday. 21 days from now is 3 weeks, so it will be Thursday.
2	A	<p>8 km</p> <p>Let the length of the path be x.</p> <p>Then cyclist spends $\frac{x}{12}$ minutes when he rides uphill and $\frac{x}{20}$ minutes when he rides down.</p> <p>$16 \text{ minutes} = \frac{16}{60} = \frac{4}{15} \text{ hours.}$</p> <p>So, $\frac{x}{12} - \frac{x}{20} = \frac{5x}{60} - \frac{3x}{60} = \frac{2x}{60} = \frac{x}{30}$.</p> <p>$\frac{x}{30} = \frac{4}{15}, x = 8$</p> <p>Therefore, the length of the path = 8 km.</p>
3	D	9
4	A	Angle for shopping is 90° . So shopping costs $\$50 \times 3 = \$150/\text{week}$. Since there are 4 weeks in a month, shopping is $\$150 \times 4 = \$600/\text{month}$
5	A	<p>Half of living expenses = $\\$200 \div 2 = \\100</p> <p>Bills normally = $3 \times \\$50 = \\150.</p> <p>Bills now = $\\$250$</p> <p>Weekly $\times 52 = \text{Yearly}$</p> <p>Yearly Bills = $52 \times \\$250$ = $\\$13\,000$</p>
6	A	<p>Third number = 28</p> <p>Twelfth number = $28 + 9 \times 8 = 100$</p>
7	A	<p>1.6% for a year.</p> <p>Suppose the fixed amount of money is $\\$1\,000$. Option A would give a simple interest of $0.016 \times \\$1\,000 = \\16. Option B would give a simple interest of $0.018 \times \frac{8}{12} \times \\$1\,000 = \\$12$. Option C would give a simple interest of $0.03 \times 0.5 \times \\$1000 = \\$15$. Option D would give a simple interest of $0.036 \times \frac{4}{12} \times \\$1\,000 = \\$12$.</p>
8	C	<p>$\frac{11}{16}$</p> <p>Container A = $\frac{3}{4} \quad \frac{1}{4} \times \frac{3}{4} = \frac{3}{16}$</p> <p>Container B = $\frac{3}{16} + \frac{1}{2} = \frac{11}{16}$</p>

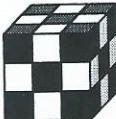
9	C	<p>Bob is twice as fast as each employee, meaning that his employees must take 6 minutes to sand a block of wood.</p> <p>In 6 minutes, Bob can sand 2 pieces. $6 \times 15 = 90$ min</p> <p>In 6 minutes, Bob and 3 employees can sand 5 pieces $6 \times 6 = 36$ min</p> <p>$90 - 36 = 54$ minutes</p>
10	D	<p>36π cm</p> <p>The larger semicircle can be calculated as one entire circle: $2\pi \times 12 = 24\pi$ cm</p> <p>The smaller semicircles can similarly be calculated this way. However you multiply by 2 as there are 2 whole circles: $2 \times (2 \times \pi \times 3) = 12\pi$ cm</p> <p>Total: $24\pi + 12\pi = 36\pi$ cm</p>

Test 09

Question Number	Answer	Solution
1	B	4 km. The question has the same conceptual meaning as the following alternate question: 'how much distance does Car B travel in 1 minute?' Since distance = speed × time, the ground Car B gains is $240 \text{ km/h} \times 1 \text{ minute}$, or $240 \div 60 = 4 \text{ km}$.
2	B	A pie chart is inappropriate because the data is not representable as parts of a whole. It represents average house prices, which is best represented as graphs that can show change over time.
3	D	110 m^2 $\text{SA} = 2 \times (2 \times 5) + 2 \times (2 \times 10) + 1 \times (10 \times 5) = 110 \text{ m}^2$ [remember that the pool has an open top]
4	A	1 part red : 3 parts blue in 500ml of purple water. Since there is double the amount of purple fire, we double that ratio. 6 parts red : 2 parts blue in 1L of purple fire. Combined they become: 7 parts red : 5 parts blue. We need $3 \times 5 = 15$ parts red. $15 - 7 = 8$ parts = 2×4 parts = 1L of red.
5	A	▲
6	A	Opposites: ■=*, ●=▽, ▲=□
7	A	
8	C	28 cm We know, the distance between the midpoints of the first two parts is 7 cm. Then length of the first two parts = $2 \times 7 = 14 \text{ cm}$. The length of the first two parts equals to the length of the third part. Therefore, the length of the segment = $2 \times 14 = 28 \text{ cm}$.
9	A	
10	A	$10 + 14 + 18 + 22 + 26 + 30 + 34 + 38 = 192$ OR $10 + 38 = 48$, $48 \times 4 = 192$

Test 10

Question Number	Answer	Solution
1	D	<p>23.4 km, 1.8 km</p> <p>Let x be the speed of the river flow. Then $13x$ is the speed of the boat. If the boat is moving downstream then the total speed = $x + 13x = 14x$ km. $14x \times 2.5 = 63$ $x = 1.8$ km (speed of the flow) $13x = 23.4$ km (speed of the boat)</p>
2	A	 <p>There are 16 blocks in this version of Chandler's view.</p>
3	D	$54 - [16 + (45 - 7)] \div 6$ (BODMAS) $54 - (16 + 38) \div 6$ $54 - 54 \div 6$ $54 - 9 = 45$
4	A	<p>Thursday</p> <p>2012 is a leap year so it will be a Thursday, 2013 Friday, 2014 Saturday, 2015 Sunday, 2016 is a leap year so it will be Tuesday, 2017 Wednesday and 2018 Thursday.</p>
5	D	<p>The shape loses 17 faces but exposes 5 new ones which means it loses 12 faces overall.</p>
6	B	$\frac{19996}{19999} \rightarrow \frac{19999}{19999} - \frac{3}{19999} \rightarrow 1 - \frac{3}{19999}$ $\frac{19987}{19990} \rightarrow \frac{19990}{19990} - \frac{3}{19990} \rightarrow 1 - \frac{3}{19990}$ $\frac{19995}{19998} \rightarrow \frac{19998}{19998} - \frac{3}{19998} \rightarrow 1 - \frac{3}{19998}$ $\frac{19992}{19995} \rightarrow \frac{19995}{19995} - \frac{3}{19995} \rightarrow 1 - \frac{3}{19995}$ <p>The fractions are now easier to work with. We are trying to find the smallest value. Looking at the fraction, the numerator is constant. We should know that the greater the denominator the smaller the value. To find the smallest value, it should be the one with the smallest denominator.</p>
7	B	<p>Topsey needs 2 strips of ribbon for each present. If there are 12 presents then she will need $12 \times 2 = 24$ strips of ribbon.</p> <p>To get 24 strips of ribbon, Topsey will need to make 23 cuts. If each cut takes 3 seconds, then it will take her $23 \times 3 = 69$ seconds.</p>

8	B	<p>Area of the rectangle = $14 \times 16 = 224 \text{ m}^2$ Area of the triangle = $0.5 \times 16 \times 5 = 40 \text{ m}^2$ Area of the semicircle = $0.5 \times \frac{22}{7} \times 7^2 = 77 \text{ m}^2$ Total area = $224 + 40 + 77 = 341 \text{ m}^2$</p>
9	D	<p>Top layer = 5 Middle layer = 4 Bottom layer = 5 $5 + 4 + 5 = 14$</p> 
10	C	<p>The only shapes that have an apex is the cone and the triangular pyramid. An apex is the highest point opposite the base of an object.</p>