1 Computation

No.	Answers	Further explanations
1	D	In order to write a number in standard form it must be written in the form $A \times 10^{\pm n}$, where $1 \leq A < 10$. Therefore, to write 0.002 51 in standard form we move the decimal point three places to the right. The number of decimal places moved gives us the value of n. If we move to the right, n will have a negative sign in front of it. The answer is, therefore, 2.51×10^{-3}. That is to say $0.002\,51 = 2.51 \times \frac{1}{10^3} = 2.51 \times \frac{1}{1000} = \frac{2.51}{1000}$
2	B	
3	B	$0.375 = \frac{375}{1000} = \frac{75}{200} = \frac{3}{8}$
4	D	$\frac{8}{0.002} = \frac{8.000}{0.002} = \frac{8000}{2} = 4000$ Move decimal point 3 places to the right Move decimal point 3 places to the right
5	B	$\begin{array}{r} {\scriptstyle 2\ 1} \\ 0.375 \times \\ 0.03 \\ \hline 0.01125 \end{array}$
6	A	
7	D	
8	C	
9	A	

No.	Answers	Further explanations
10	A	
11	A	
12	C	$2\frac{2}{3} + 3\frac{1}{4}$ $5\frac{8+3}{12} = \frac{11}{12}$ $\therefore$ Answer $= 5\frac{11}{12}$
13	D	$4\frac{3}{5} - 2\frac{1}{2}$ $2\frac{6-5}{10} = \frac{1}{10}$ $\therefore$ Answer $= 2\frac{1}{10}$
14	D	
15	C	
16	D	$\left(\frac{3}{5} \times \frac{25}{24}\right) \div \frac{2}{3} = \left(\frac{1}{1} \times \frac{5}{8}\right) \div \frac{2}{3} = \frac{5}{8} \times \frac{3}{2} = \frac{15}{16}$
17	B	
18	A	$3\frac{5}{8} = 3.625$ 3.625 written to <u>three</u> significant figures is 3.63.
19	A	
20	C	The ratio is given as 3 : 5 : 7. There are, therefore, $3 + 5 + 7 = 15$ parts to share. Daniel and Victoria received 36 tokens. This represents a combined share of $5 + 7 = 12$ parts. 12 parts represents 36 tokens. Therefore, 15 parts represents $\frac{15 \times 36}{12} = 15 \times 3 = 45$ tokens.
21	B	

No.	Answers	Further explanations
22	D	
23	A	$\frac{5}{40} \times 100 = \frac{100}{8} = 12.5\%$
24	B	Let the unknown number be x. Therefore, 40% of x is 120. $0.4x = 120$ $x = \frac{120}{0.4}$ $x = 300$
25	A	$12\frac{1}{2}\% \times 800 = 0.125 \times 800 = 100$
26	B	
27	D	
28	C	Sandra's score $= 90\% \times 60 = \frac{90}{100} \times \frac{60}{1} = 54$
29	C	
30	B	
31	B	$16^2 = 256$ Then $\sqrt{256} = 16$ Therefore, $\sqrt{0.0256} = \sqrt{\frac{256}{10\,000}} = \frac{\sqrt{256}}{\sqrt{10\,000}} = \frac{16}{100} = 0.16$
32	A	
33	B	
34	A	US\$1.00 = TT\$6.50. Therefore, US\$300 = 300 × 6.50 = TT\$1950.
35	D	2.5 metres = 2.5 × 100 centimetres = 250 centimetres.
36	A	3500 millimetres = 3500/1000 metres = 3.5 metres.

No.	Answers	Further explanations
37	C	2.2 tonnes = 2.2×1000 kilograms = 2200 kilograms.
38	A	$(-2)^3 + (-1)^3 = -8 + (-1) = -9$
39	B	$-\left(\frac{1}{3}\right)^3 = -\left(\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3}\right) = -\frac{1}{27}$
40	A	$(-3)^2 + (-1)^3 = 9 + (-1) = 8$

2 Number Theory

No.	Answers	Further explanations
1	C	The first step is to find all the prime factors of 36, 60 and 96. $2\overline{)36}$ $2\overline{)18}$ $3\overline{)9}$ $3\overline{)3}$ 1 $2\overline{)60}$ $2\overline{)30}$ $3\overline{)15}$ $5\overline{)5}$ 1 $2\overline{)96}$ $2\overline{)48}$ $2\overline{)24}$ $2\overline{)12}$ $2\overline{)6}$ $3\overline{)3}$ 1 $36 = 2 \times 2 \times 3 \times 3$ $60 = 2 \times 2 \times 3 \times 5$ $96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$ Therefore, $36 = \boxed{2} \times \boxed{2} \times \boxed{3} \times 3$ $60 = \boxed{2} \times \boxed{2} \times \boxed{3} \times 5$ $96 = \boxed{2} \times \boxed{2} \times 2 \times 2 \times 2 \times \boxed{3}$ The highest common factor (HCF) is found by multiplying the factors that repeat in all three numbers: HCF = $2 \times 2 \times 3 = 12$

No.	Answers	Further explanations
2	A	The first thing to do is to find the lowest common multiple (LCM) of 2, 6, 4 and 12 (the denominator of each fraction given). $2 \mid 2, 6, 4, 12$ $2 \mid 1, 3, 2, 6$ $3 \mid 1, 3, 1, 3$ $1, 1, 1, 1$ The LCM of 2, 6, 4 and $12 = 2 \times 2 \times 3 = 12$ The next step is to write each fraction such that the denominator of each is the same: $\frac{1}{2}, \frac{5}{6}, \frac{3}{4}, \frac{1}{12}$ $\frac{6, 10, 9, 1}{12}$ Therefore, $\frac{1}{2} = \frac{6}{12}$ $\frac{5}{6} = \frac{10}{12}$ $\frac{3}{4} = \frac{9}{12}$ $\frac{1}{12} = \frac{1}{12}$ Arranging the fractions in ascending order: $\frac{1}{12}, \frac{6}{12}, \frac{9}{12}, \frac{10}{12}$. Therefore, the final answer is $\frac{1}{12}, \frac{1}{2}, \frac{3}{4}, \frac{5}{6}$.
3	B	
4	D	$2 \mid 6, 9, 12$ $2 \mid 3, 9, 6$ $3 \mid 3, 9, 3$ $3 \mid 1, 3, 1$ $1, 1, 1$ The lowest common multiple of 6, 9 and $12 = 2 \times 2 \times 3 \times 3 = 36$.

No.	Answers	Further explanations
5	A	Multiples of 2: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, … Multiples of 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, … Multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, … The first three common multiples of 2, 3 and 4 are 12, 24 and 36.
6	A	Using the distributive law: $63 \times 18 + 63 \times 2 = 63 \times (18 + 2) = 63 \times 20$
7	D	
8	C	In order to identify a prime number you can eliminate the ones that are not. 45 is divisible by 5 because the last digit is 5. 46 is divisible by 2 because the last digit is 6 (even). 49 is divisible by 7. Therefore, 47 is the prime number.
9	C	
10	D	
11	B	
12	B	
13	C	
14	A	The given sequence is 4, 7, 11, 16. The difference between the consecutive terms is as follows: The difference between 4 and 7 is 3. The difference between 7 and 11 is 4. The difference between 11 and 16 is 5. Notice that the difference increases by 1. Therefore, the difference between 16 and the next term should be 6. So the next term in the sequence 4, 7, 11, 16 is (16 + 6 = 22).

No.	Answers	Further explanations
15	D	25.634 Digit 3 is 3 hundredths = $\frac{3}{100}$
16	A	$37 \times 225 = 37 \times (200 + 25) = (37 \times 200) + (37 \times 25)$
17	C	
18	D	365 can be written as 300 + 60 5 365 $300 = 3 \times 10^2$ $60 = 6 \times 10^1$ $5 = 5 \times 10^0$ Therefore, $365 = 3 \times 10^2 + 6 \times 10^1 + 5 \times 10^0$

3 Consumer Arithmetic

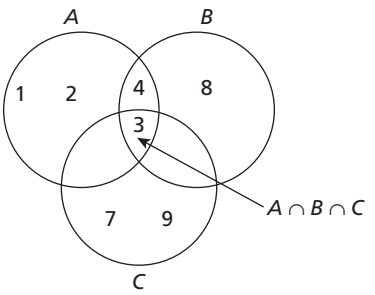
No.	Answers	Further explanations
1	B	
2	A	Loan amount = \$10 000 Total amount paid back on loan = $\$500 \times 2 \times 12 = \$12\,000$ Interest = $\$12\,000 - \$10\,000 = \$2000$ $R = \frac{100 \times I}{P \times T} = \frac{100 \times 2000}{10\,000 \times 2} = 10\%$
3	B	

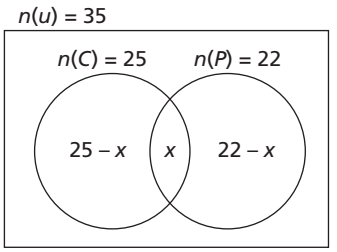
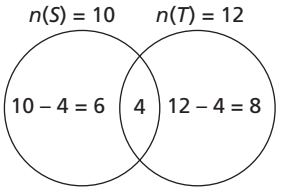
No.	Answers	Further explanations
4	C	Interest received by Adam = $I = \frac{P \times R \times T}{100} = \frac{300 \times 5 \times 4}{100} = \$60$ Interest received by Ann = $I = \frac{P \times R \times T}{100} = \frac{400 \times 5 \times T}{100}$ Since Adam and Ann received the same interest: $\frac{400 \times 5 \times T}{100} = 60$ $400 \times 5 \times T = 60 \times 100$ $2000 \times T = 6000$ $T = 6000/2000$ $T = 3$ years
5	A	
6	C	Cash price = \$2000 Total amount paid on hire purchase = \$900 + (12 × \$120) = \$900 + \$1440 = \$2340 Amount of money that can be saved if the television is bought at the cash price = \$2340 − \$2000 = \$340
7	A	Amount paid in tax = 2500 × \$0.80 = \$2000
8	B	Taxable income = 60 000 − 15 000 = \$45 000 Tax payable = 25% × \$45 000 = $\frac{25}{100} \times 45\,000 = \$11\,250$
9	C	Tax paid = 10% × \$150 = $\frac{10}{100} \times 150 = \$15$ Amount Alex has to pay the delivery man = \$150 + \$15 = \$165 Change received = \$200 − \$165 = \$35
10	C	
11	A	Original price of tool = \$800 Price is increased by 12.5% Final price = 800 + (12.5% × 800) = $800 + \left(\frac{125}{1000} \times \frac{800}{1}\right) = \$900$
12	A	

No.	Answers	Further explanations
13	D	Discount = 5% × \$1400 = 0.05 × 1400 = \$70 Amount paid at the cashier = \$1400 − \$70 = \$1330
14	C	Insurance for home = 6000 × 0.20 = \$1200 Insurance for contents of home = 1000 × 0.60 = \$600 Insurance that will have to be paid = \$1200 + \$600 = \$1800
15	B	Initial value of car = \$180 000 Depreciation rate = 10% per annum After the first year the value of the car = 180 000 − (180 000 × 0.10) = \$162 000 After the second year the value of the car = 162 000 − (162 000 × 0.10) = \$145 800
16	C	Let the rate of depreciation be r%. Original price = \$$x$ Value of car on December 31st = $x - x - \left(\frac{r}{100} \times x\right) = x\left(1 - \frac{r}{100}\right)$ The value of the car on December 31st is given as $0.95x$. Therefore, $\left(1 - \frac{r}{100}\right) = 0.95$ $\frac{r}{100} = 1 - 0.95$ $\frac{r}{100} = 0.05$ $r = 100 \times 0.05$ $r = 5\%$
17	C	Let the number of units of electricity be x. Adam's bill = \$54 $3 + (200 \times 0.12) + 0.09(x - 200) = 54$ $3 + 24 + 0.09x - 18 = 54$ $0.09x = 54 - 24 - 3 + 18$ $0.09x = 45$ $x = 45/0.09$ $x = 500$ units
18	C	Profit = $\frac{2400 - 2000}{2000} \times 100\% = 20\%$

No.	Answers	Further explanations
19	D	Loan = \$10 000 Amount paid back on loan = $3 \times 12 \times 300 = \$10\,800$ Profit = $\frac{10\,800 - 10\,000}{10\,000} \times 100\% = 8\%$
20	B	
21	C	
22	A	
23	D	Let the marked price be x. Discount = 20% (\$200) Therefore, 20% of x = \$200 $\frac{20}{100} \times x = 200$ $20x = 20\,000$ $x = \frac{20\,000}{20}$ x = \$1000
24	B	
25	B	
26	D	Fixed charge = \$50 Hourly rate = \$20 Total charge = \$130 Let the number of hours be x. Therefore, $20x + 50 = 130$ $20x = 130 - 50$ $20x = 80$ $x = 80/20$ x = 4 hours
27	C	

4 Sets

No.	Answers	Further explanations
1	B	
2	C	
3	D	
4	B	
5	C	There are 3 members of set A. Therefore, the number of subsets $= 2^n = 2^3 = 8$
6	D	
7	B	
8	C	
9	B	$A \cap B \cap C$ represents all the members that are common to all sets:  $A \cap B \cap C = \{3\}$

No.	Answers	Further explanations
10	D	 Let the number of students who study both subjects be x. Therefore: The number of students who study chemistry only $= 25 - x$ The number of students who study physics only $= 22 - x$ $25 - x + x + 22 - x = 35$ $47 - x = 35$ $x = 47 - 35$ $x = 12$
11	B	
12	C	
13	D	
14	B	
15	A	
16	D	
17	A	 From the diagram: $n(S \cup T) = 6 + 4 + 8 = 18$
18	A	
19	C	
20	D	

No.	Answers	Further explanations
21	B	$P = \{2, 4, 6, 8, 10, 12\}$ $Q = \{1, 2, 3, 4, 6, 8, 12, 24\}$ The diagram shows $P \cap Q$ Therefore, $P \cap Q = \{2, 4, 6, 8, 12\}$
22	A	
23	B	
24	D	
25	B	
26	D	
27	C	
28	C	If we look at the Venn diagram we can infer that: • all students who study physics study maths, because physics is a subset of maths • there are some students who study both accounts and maths, since these two sets intersect • there are no students who study accounts and physics, because these two sets do not intersect. Therefore, the answer is I and III.
29	B	
30	C	

5 Measurement

No.	Answers	Further explanations
1	B	The perimeter of the triangle is 24 cm and the lengths of its sides are x, $2x$ and $3x$. Therefore, $x + 2x + 3x = 24$ $6x = 24$ $x = \frac{24}{6}$ $x = 4$ cm
2	D	The perimeter of the triangle is 26 cm and the lengths of its sides are $(x - 1)$, $(x + 3)$ and $(x + 6)$. Therefore, $(x - 1) + (x + 3) + (x + 6) = 26$ $3x - 1 + 3 + 6 = 26$ $3x + 8 = 26$ $3x = 26 - 8$ $3x = 18$ $x = \frac{18}{3}$ $x = 6$ cm Length of the longest side = $(x + 6) = 6 + 6 = 12$ cm.
3	A	Perimeter of shape = $3 + 4 + 4 + \frac{2\pi\left(\frac{3}{2}\right)}{2} = 11 + \frac{3\pi}{2}$
4	B	

No.	Answers	Further explanations
5	C	Area of rectangle $= l \times b$ Given that $l \times b = 48$ New length $= \frac{1}{2}l$ New breadth $= 3b$ New area $= \frac{1}{2}l \times 3b = \frac{3}{2}lb$ But $lb = 48$ Therefore, new area $= \frac{3}{2} \times 48 = 72\ \text{cm}^2$
6	D	
7	C	Area of outer circle with radius 8 cm $= \pi(8)^2 = 64\pi$ Area of inner circle with radius 6 cm $= \pi(6)^2 = 36\pi$ Area of shaded region $= 64\pi - 36\pi = 28\pi$
8	A	
9	A	Area of parallelogram = length DC × perpendicular distance between lines AB and DC Perpendicular distance between the lines AB and DC $= 4 \times \sin 60°$ Therefore, area of parallelogram $= 6 \times 4 \times \sin 60°\ \text{cm}^2$
10	C	
11	B	A cube has six faces. The area of one face $= \frac{54}{6} = 9\ \text{cm}^2$ Therefore, the length of one side $= \sqrt{9} = 3$ cm
12	B	Volume of a cube $= (\text{side})^3 = 5^3 = 125\ \text{cm}^3$
13	D	

No.	Answers	Further explanations
14	B	Given that the circumference = 44 cm The circumference of a circle is given by $C = 2\pi r$ Therefore, $2 \times \pi \times r = 44$ $r = \frac{44}{2\pi}$ $r = \frac{22}{\pi}$
15	D	
16	B	
17	A	
18	D	The length of an arc of a sector = $\frac{\theta}{360} \times 2 \times \pi \times r = \frac{60}{360} \times 2 \times \frac{22}{7} \times 7 = \frac{22}{3}$ cm
19	B	The area of a sector = $\frac{\theta}{360} \times \pi r^2$: $\frac{30}{360} \times \pi \times 12^2 = 12\pi$ cm^2
20	C	$AX = \frac{1}{2}AB = \frac{1}{2} \times 16 = 8$ cm Using Pythagoras' theorem: $AX^2 + OX^2 = OA^2$ $8^2 + OX^2 = 10^2$ $OX^2 = 10^2 - 8^2$ $OX^2 = 100 - 64$ $OX^2 = 36$ $OX^2 = \sqrt{36}$ $OX = 6$ cm
21	C	
22	A	

No.	Answers	Further explanations
23	B	
24	B	8 litres = $8 \times 1000\ cm^3 = 8000\ cm^3$ Each cup has a capacity of $250\ cm^3$ Therefore, the number of cups = $\frac{8000}{250} = 32$
25	B	
26	A	Start time = 06:20 End time = 07:05 Duration = 07:05 − 06:20 = 45 minutes Converting 45 minutes into hours: $\frac{45}{60} = 0.75$ hour Distance = speed × time $= 60 \times 0.75$ = 45 km
27	C	
28	B	8 cm on the map represents an actual distance of 20 km. Therefore, the scale is determined as follows: 8 cm : 20 km 8 cm : 20 000 m (Convert kilometres to metres by multiplying by 1000) 8 cm : 2 000 000 cm (Convert metres to centimetres by multiplying by 100) 8 : 2 000 000 (Divide both sides by 8) 1 : 250 000

No.	Answers	Further explanations
29	C	Each exterior angle in a regular polygon = 360/n, where n is the number of sides in the regular polygon. It is given that each exterior angle of a regular polygon is 60°. Therefore, $\frac{360}{n} = 60$ $60n = 360$ $n = \frac{360}{60}$ $n = 6$ (i.e. a hexagon)

6 Statistics

No.	Answers	Further explanations
1	A	
2	A	
3	A	
4	A	

Length, x (cm)	Frequency, f	xf
4	3	12
5	6	30
6	4	24
7	a	b
8	2	16
Total		96

The sum of the xf column is 96.

From the table, $b = 7a$

Summing the xf column and equating it to 96.

$12 + 30 + 24 + 7a + + 16 = 96$

$7a + 82 = 96$

$7a = 96 - 82$

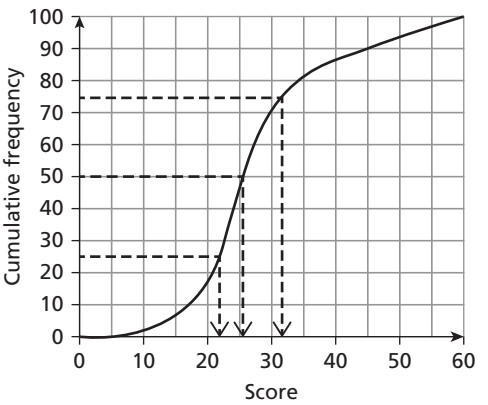
$7a = 14$

$a = \frac{14}{7}$

$a = 2$

So 7 cm occurred twice.

No.	Answers	Further explanations
5	A	The mean of 5 numbers is 7. Therefore, $\frac{2+5+8+x+14}{5} = 7$ $2+5+8+x+14 = 7\times 5$ $x+29 = 35$ $x = 35-29$ $x = 6$
6	B	
7	D	The mean of 6 numbers is 8. Therefore, $8 = \frac{\text{sum}}{6}$ $\text{sum} = 8\times 6$ $\text{sum} = 48$ The number 15 is added to the 6 numbers. New sum = 48 + 15 = 63, and there are now 7 numbers. New mean = $\frac{63}{6+1} = \frac{63}{7} = 9$
8	B	
9	A	
10	B	
11	C	
12	C	
13	B	
14	A	
15	B	

No.	Answers	Further explanations
16	D	Rent = 30%, food = 20%, transportation = 10%, savings = ? Savings = 100% − (30% + 20% + 10%) = 100% − 60% = 40% Angle of sector representing savings = 40% × 360° = 0.4 × 360° = 144°
17	A	
18	D	
19	B	
20	B	
21	C	 In order to determine the median, read from the graph the value of the score when the cumulative frequency = 50. Median score = 25
22	B	In order to determine the lower quartile, read from the graph the value of the score when the cumulative frequency = 25. Lower quartile $Q_1 = 23$
23	D	In order to determine the upper quartile, read from the graph the value of the score when the cumulative frequency = 75. Lower quartile $Q_3 = 32$
24	A	The interquartile range = $\frac{1}{2}(Q_3 - Q_1) = \frac{1}{2}(32 - 23) = 4.5$

<table>
<tr><th>No.</th><th>Answers</th><th>Further explanations</th></tr>
<tr><td>25</td><td>C</td><td></td></tr>
<tr><td>26</td><td>B</td><td></td></tr>
<tr><td>27</td><td>D</td><td></td></tr>
<tr><td>28</td><td>C</td><td></td></tr>
<tr><td>29</td><td>B</td><td>
<table>
<tr><td>Height (cm)</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr>
<tr><td>Number of seedlings</td><td>1</td><td>1</td><td>2</td><td>6</td><td>10</td><td>12</td><td>8</td><td>7</td><td>3</td></tr>
</table>
The number of seedlings having a height less than 14 cm = 1 + 1 + 2 + 6 = 10
Total number of seedlings = 1 + 1 + 2 + 6 + 10 + 12 + 8 + 7 + 3 = 50
$P(\text{height less than 14 cm}) = \frac{10}{50} = \frac{1}{5}$
</td></tr>
<tr><td>30</td><td>C</td><td>
Since only one face of a die has a 5 on it,
$P(5) = \frac{1}{6}$
There are three odd numbers on the faces of a die. They are 1, 3 and 5.
Therefore, $P(\text{odd number}) = \frac{3}{6}$
$P(\text{getting a 5 followed by an odd number}) = P(5) \times P(\text{odd number})$
$= \frac{1}{6} \times \frac{3}{6}$
$= \frac{1}{6} \times \frac{1}{2}$
</td></tr>
<tr><td>31</td><td>C</td><td></td></tr>
</table>

7 Algebra

No.	Answers	Further explanations
1	D	$-3(x-2) = (-3 \times x) \times (-3 \times 2) = -3x + 6$
2	B	$2x(x+3y) - y(2x-4y) = 2x^2 + 6xy - 2xy + 4y^2$ (Use the distributive law to remove the brackets) $= 2x^2 + 4xy + 4y^2$
3	C	$\frac{27x - 18}{3} = \frac{27x}{3} - \frac{18}{3} = 9x - 6$
4	A	$a = 5(p-q)$ $a = 5p - 5q$ $5p = a + 5q$ $2(5p) = 2(a+5q)$ (Multiplying both sides by 2) $10p = 2(a+5q)$
5	A	$2x(2+3y) - 3x(1-2y) = 4x + 6xy - 3x + 6xy$ $= 4x - 3x + 6xy + 6xy$ $= x + 12xy$
6	A	
7	A	$3 * 2 = \frac{\sqrt{ab-b}}{a^2} = \frac{\sqrt{(3\times 2)-2}}{(3)^2} = \frac{\sqrt{4}}{9} = \frac{2}{9}$
8	B	$3(ab^2)^3 = 3a^3b^{(2\times 3)} = 3a^3b^6$
9	B	$(3x)^3 = 3^3 \times x^3 = 27x^3$
10	A	$(-3pq^2)(-2p^3q) = (-3 \times -2)\, p^{(1+3)}q^{(2+1)} = 6p^4q^3$
11	B	$3^8 \div 3^{-2} = 3^{(8-(-2))} = 3^{8+2} = 3^{10}$

No.	Answers	Further explanations
12	B	$6(x-2)-3(x-1)=6$ (Use the distributive law to expand the left-hand side) $6x-12-3x+3=6$ $3x-9=6$ $3x=6+9$ (Adding 9 to both sides of the equation) $x=\frac{15}{3}$ (Dividing both sides of the equation by 3) $x=5$
13	D	$\frac{3x}{100}=27$ $3x=27\times 100$ $3x=2700$ $x=\frac{2700}{3}$ $x=900$
14	D	$3x-25=x+17$ $3x-x=17+25$ $2x=42$ $x=\frac{42}{2}$ $x=21$
15	C	$(2x-1)-6(x-1)+7=0$ $2x-1-6x+6+7=0$ $2x-6x-1+6+7=0$ $-4x+12=0$ $4x=12$ $x=\frac{12}{4}$ $x=3$

No.	Answers	Further explanations
16	D	$12 < x - 3 < 24$ $12 + 3 < x < 24 + 3$ $15 < x < 27$ Therefore, 16 lies within this range.
17	A	$3x - 2 \leq 13$ $3x \leq 13 + 2$ $3x \leq 15$ $x \leq \frac{15}{3}$ $x \leq 5$
18	D	$125 < 5 - 3x$ $125 - 5 < -3x$ $120 < -3x$ $\frac{120}{-3} > \frac{-3x}{-3}$ $-40 > x$ $x < -40$
19	D	
20	B	
21	A	Nyla's current age = $(2x - 4) + 2$ Since Nyla is 6 times the age of Anya, Anya's current age = $\frac{(2x-4)+2}{6} = \frac{2x-2}{6} = \frac{2(x-1)}{6} = \frac{x-1}{3}$
22	C	
23	A	

No.	Answers	Further explanations
24	C	Let one number be x and another number be y. The square of each number is x^2 and y^2. The difference of two square numbers is $x^2 - y^2$. Two times the difference of two square numbers is $2(x^2 - y^2)$. Given that the difference of two square numbers is negative, this means that $2(x^2 - y^2) < 0$.
25	C	
26	A	
27	C	
28	B	$\frac{5x}{3y} + \frac{2x}{5y}$ (The lowest common multiple of $3y$ and $5y$ is $15y$) $\frac{15y}{3y} = 5$ $\frac{15y}{5y} = 3$ $\frac{5(5x) + 3(2x)}{15y} = \frac{25x + 6x}{15y} = \frac{31x}{15y}$
29	B	$\frac{2a}{5b} - \frac{7c}{2d}$ (The lowest common multiple of $5b$ and $2d$ is $10bd$) $\frac{10bd}{5b} = 2d$ $\frac{10bd}{2d} = 5b$ $\frac{2d(2a) - 5b(7c)}{10bd} = \frac{4ad - 35bc}{10bd}$
30	C	

No.	Answers	Further explanations
31	A	$y \propto \frac{1}{x^2}$ $y = \frac{1}{x^2}$ When $x = 2$ and $y = 9$: $9 = \frac{k}{2^2}$ $9 = 4k$ $k = 36$ The equation relating x and y is $y = \frac{36}{x^2}$ When $x = 3$, $y = \frac{36}{3^2} = \frac{36}{9} = 4$
32	B	
33	D	
34	B	
35	D	
36	B	$y = k\sqrt{\frac{x}{m}}$ $\frac{y}{k} = \sqrt{\frac{x}{m}}$ (Divide both sides by k) $\left(\frac{y}{k}\right)^2 = \frac{x}{m}$ (Square both sides) $\frac{y^2}{k^2} = \frac{x}{m}$ $my^2 = k^2x$ (Cross-multiply) $m = \frac{k^2x}{y^2}$ (Divide both sides by y^2)
37	D	
38	B	

No.	Answers	Further explanations
39	B	
40	B	

8 Relations, Functions and Graphs

No.	Answers	Further explanations
1	D	If an equation of a line is in the form $y = mx + c$, then m is the gradient of the line. $1 - 2y = 6x$ $-2y = 6x - 1$ $y = -3x + \frac{1}{2}$ Therefore, the gradient of the line is –3.
2	A	
3	B	
4	A	
5	C	
6	B	If a point lies on the line $y = 3x + 2$ the coordinates must satisfy the equation. The point (–1, –1) lies on the line because $x = -1$ and $y = -1$ satisfy the equation. $-1 = 3(-1) + 2$ $-1 = -3 + 2$ $-1 = -1$
7	C	If the gradient of the line P is 2, then the gradient of any line parallel to P must be 2. $3y = 6x + 2$ $y = 2x + \frac{2}{3}$ This line is parallel to P since its gradient m (from $y = mx + c$) is also 2.

No.	Answers	Further explanations
8	A	The equation for the line R is $2y = 3 - x$. $2y = -x + 3$ $y = -\frac{1}{2}x + \frac{3}{2}$ The gradient of R is therefore $-\frac{1}{2}$. When two lines are perpendicular, the product of their gradients is –1. Therefore, any line perpendicular to R must have a gradient m of $-\frac{1}{2} \times m = -1$ $\frac{1}{2}m = 1$ $m = 2$. The line $y = 2x + 1$, has a gradient of 2, and is therefore perpendicular to R.
9	C	
10	D	
11	C	
12	A	The line $y = 0$ is the x-axis. The curve intersects the x-axis at $x = -3$ and $x = 1$.
13	C	The minimum point of the curve is (–1, –4).
14	B	Reading off the values of x when $y = -3$: $x = -2$ and $x = 0$
15	D	
16	D	
17	A	
18	C	
19	B	
20	B	

No.	Answers	Further explanations
21	C	
22	B	
23	B	
24	A	$3x^2 + 6x - 2 = a(x + h)^2 + k$ $3x^2 + 6x - 2 = a(x^2 + 2hx + h^2) + k$ $3x^2 + 6x - 2 = ax^2 + 2ahx + ah^2 + k$ Equating coefficients: $\underline{a = 3}$ $2ah = 6$ $2(3)h = 6$ $h = \frac{6}{6}$ $\underline{h = 1}$ $ah^2 + k = -2$ $(3)(1)^2 + k = -2$ $3 + k = -2$ $k = -2 - 3$ $\underline{k = -5}$
25	C	
26	C	
27	C	
28	C	A vertical line test is used to identify a function. When a vertical line is drawn it must intersect the curve at only *one point* in order to be a function. This is true for all the curves except C.
29	A	
30	A	If $f(x) = 3x^2 - 2$ Then, $f(-2) = 3(-2)^2 - 2 = 3(4) - 2 = 12 - 2 = 10$
31	B	

No.	Answers	Further explanations
32	C	
33	A	
34	B	
35	B	
36	A	
37	D	
38	A	
39	B	$f(-3) = 2(-3) + 3 = -3$
40	A	Let $y = 2x + 3$ Interchange x and y: $x = 2y + 3$ $2y = x - 3$ $y = \frac{x - 3}{2}$ Therefore, $f^{-1}(x) = \frac{x - 3}{2}$
41	B	$f^{-1}(-1) = \frac{-1 - 3}{2} = -\frac{4}{2} = -2$
42	A	In order to find fg(2), first find g(2): $g(2) = (2)^2 - 2 = 4 - 2 = 2$ Now find f(2): $f(2) = 2(2) + 3 = 4 + 3 = 7$ Therefore, $fg(2) = 7$

No.	Answers	Further explanations
43	C	First find fg(x): $f(x) = 2x + 3$ $g(x) = x^2 - 2$ $fg(x) = 2(x^2 - 2) + 3 = 2x^2 - 4 + 3 = 2x^2 - 1$ Let $y = 2x^2 - 1$ Interchange x and y: $x = 2y^2 - 1$ $2y^2 = x + 1$ $y^2 = \frac{x+1}{2}$ $y = \sqrt{\frac{x+1}{2}}$ $(fg)^{-1}(x) = \sqrt{\frac{x+1}{2}}$
44	D	In order to find the inverse of the function f(x), perform the following steps. Given that $f(x) = 3x - 2$ Let $y = 3x - 2$ Interchange x and y: $x = 3y - 2$ $3y - 2 = x$ $3y = x + 2$ $y = \frac{x+2}{3}$ Therefore, $f^{-1}(x) = \frac{x+2}{3}$
45	B	
46	A	
47	B	

No.	Answers	Further explanations
48	D	
49	D	The shaded region lies between the lines $y = 2$ and $y = -1$. Therefore, $\{(x, y): -1 \leq y \leq 2\}$
50	A	
51	D	
52	A	
53	C	
54	B	
55	B	

9 Geometry and Trigonometry

No.	Answers	Further explanations
1	C	
2	B	Use Pythagoras' theorem to find the length AC: $AC^2 + BC^2 = AB^2$ $AC^2 + 12^2 = 13^2$ $AC^2 + 144 = 169$ $AC^2 = 169 - 144$ $AC^2 = 25$ $AC = \sqrt{25}$ $AC = 5$ Therefore, $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{AC}{AB} = \frac{5}{13}$

No.	Answers	Further explanations
3	C	
4	B	$\sin(180° - \theta) = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{\text{PR}}{\text{PQ}}$
5	C	
6	D	Use Pythagoras' theorem to find the length AC: $\text{AC}^2 + \text{BC}^2 = \text{AB}^2$ $\text{AC}^2 + p^2 = \left(\sqrt{p^2 + 9}\right)^2$ $\text{AC}^2 + p^2 = p^2 + 9$ $\text{AC}^2 = p^2 + 9 - p^2$ $\text{AC}^2 = 9$ $\text{AC} = \sqrt{9}$ $\text{AC} = 3$ Therefore, $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{\text{AC}}{\text{AB}} = \frac{3}{\sqrt{p^2 + 9}}$
7	B	
8	B	Use Pythagoras' theorem to find BC: $\text{AC}^2 + \text{BC}^2 = \text{AB}^2$ $8^2 + \text{BC}^2 = 10^2$ $64 + \text{BC}^2 = 100$ $\text{BC}^2 = 100 - 64$ $\text{BC}^2 = 36$ $\text{BC} = \sqrt{36}$ $\text{BC} = 6$ cm
9	A	$\tan \text{CDB} = \frac{\text{opposite}}{\text{adjacent}} = \frac{\text{BC}}{\text{BD}} = \frac{6}{5}$

No.	Answers	Further explanations
10	B	Use Pythagoras' theorem to find BD: $BD^2 = BC^2 + CD^2$ $BD^2 = 6^2 + 5^2$ $BD^2 = 36 + 25$ $BD^2 = \sqrt{61}$ $\cos CBD = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{BC}{BD} = \frac{6}{\sqrt{61}}$
11	C	
12	B	
13	D	
14	D	
15	C	
16	A	
17	B	
18	C	
19	A	
20	C	
21	A	
22	A	PRQ = 180 − (90 + 55) = 180 − 145 = 35° (Also, PSQ = 35°, as the angles subtended by an arc in the same segment of a circle are equal.)

No.	Answers	Further explanations
23	D	The angle subtended at the centre of a circle is twice the angle subtended at the circumference: $\theta = 2 \times 60 = 120°$
24	A	$\text{MOX} = \frac{100}{2} = 50°$ $\text{LOM} = 180 - 50 = 130°$ $\text{OML} = \frac{180 - 130}{2} = \frac{50}{2} = 25°$
25	C	
26	B	
27	B	
28	A	$\text{DEB} = 180 - 63 = 117°$
29	D	Opposite angles of a cyclic quadrilateral: $\text{BCD} = 180 - 117 = 63°$
30	C	The angle between a tangent and a chord through the point of contact is equal to the angle subtended by the chord in the alternate segment: $\text{ABC} = 53°$
31	A	The angle subtended at the centre of a circle is twice the angle subtended at the circumference: $\text{AOC} = 2 \times 53 = 106°$
32	D	PQ is a tangent to the circle at the point A. Therefore, $\text{PAO} = 90°$: $\text{BAP} = 90 - 22 = 68°$
33	D	
34	B	
35	C	
36	C	
37	B	
38	A	

No.	Answers	Further explanations
39	A	
40	A	
41	D	
42	B	
43	A	
44	C	
45	C	
46	A	
47	D	
48	B	
49	B	
50	B	
51	C	
52	D	
53	A	
54	B	
55	B	
56	C	
57	D	
58	A	
59	A	

No.	Answers	Further explanations
60	C	

10 Vectors and Matrices

No.	Answers	Further explanations
1	D	$\mathbf{A}+2\mathbf{B}=\begin{pmatrix}2&1\\3&4\end{pmatrix}+2\begin{pmatrix}1&2\\-1&3\end{pmatrix}$ $=\begin{pmatrix}2&1\\3&4\end{pmatrix}+\begin{pmatrix}2&4\\-2&6\end{pmatrix}$ $=\begin{pmatrix}2+2&1+4\\3+(-2)&4+6\end{pmatrix}$ $=\begin{pmatrix}4&5\\1&10\end{pmatrix}$
2	A	
3	A	$\mathbf{PQ}=\begin{pmatrix}1&3\\-1&2\end{pmatrix}\begin{pmatrix}2&-1\\-1&4\end{pmatrix}$ $=\begin{pmatrix}((1\times2)+(3\times-1))&((1\times-1)+(3\times4))\\((-1\times2)+(2\times-1))&((-1\times-1)+(2\times4))\end{pmatrix}$ $=\begin{pmatrix}2+(-3)&-1+12\\-2+(-2)&1+8\end{pmatrix}$ $=\begin{pmatrix}-1&11\\-4&9\end{pmatrix}$
4	A	
5	B	
6	B	

No.	Answers	Further explanations
7	D	
8	A	If a matrix is singular, the determinant = 0. Therefore, $(2p \times 2) - (6 \times -2) = 0$ $4p - (-12) = 0$ $4p + 12 = 0$ $4p = -12$ $p = -\frac{12}{4}$ $p = -3$
9	C	
10	B	Given that $\mathbf{A} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ The inverse $\mathbf{A}^{-1} = \frac{1}{\lvert\mathbf{A}\rvert}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ Therefore, the inverse of the matrix $\mathbf{A} = \begin{pmatrix} 2 & 2 \\ -1 & 3 \end{pmatrix}$ is $\frac{1}{8}\begin{pmatrix} 3 & -2 \\ 1 & 2 \end{pmatrix}$

No.	Answers	Further explanations
11	B	$\begin{pmatrix} 1 & 2 \\ 3 & -5 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ Equation (1) Let $\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 3 & -5 \end{pmatrix}$ Therefore, $\mathbf{A}^{-1} = \frac{1}{(1\times -5)-(2\times 3)}\begin{pmatrix} -5 & -2 \\ -3 & 1 \end{pmatrix}$ $= \frac{1}{(-5)-(6)}\begin{pmatrix} -5 & -2 \\ -3 & 1 \end{pmatrix}$ $= \frac{1}{-11}\begin{pmatrix} -5 & -2 \\ -3 & 1 \end{pmatrix}$ Multiply both sides of Equation (1) by $\mathbf{A}^{-1}$: $\frac{1}{-11}\begin{pmatrix} -5 & -2 \\ -3 & 1 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 3 & -5 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{-11}\begin{pmatrix} -5 & -2 \\ -3 & 1 \end{pmatrix}\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = -\frac{1}{11}\begin{pmatrix} ((-5\times 4)+(-2\times 1)) \\ ((-3\times 4)+(1\times 1)) \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = -\frac{1}{11}\begin{pmatrix} -22 \\ -11 \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ Therefore, $x = 2$ and $y = 1$.
12	B	
13	A	Given that P (–2, 3) P undergoes a translation of $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$, and the image is P′: $\mathrm{P}' = \begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} -1 \\ 3 \end{pmatrix} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$ Therefore, the coordinates of P′ are (–3, 6).

No.	Answers	Further explanations
14	B	
15	C	
16	C	
17	A	P (2, 1) and $M = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ $P' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ $= \begin{pmatrix} ((0 \times 2) + (-1 \times 1)) \\ ((1 \times 2) + (0 \times 1)) \end{pmatrix}$ $= \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ The coordinates of the image P′ are (–1, 2)
18	D	
19	A	Let A be a rotation of 90° in a clockwise direction $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ Let B be a reflection in the y-axis $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
20	B	The magnitude of $\overrightarrow{OA}$ is $\left\lvert\overrightarrow{OA}\right\rvert = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ units.
21	D	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = \begin{pmatrix} -2 \\ -4 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$
22	B	
23	B	From O to A, move 3 units to the right and 4 units upwards: $\overrightarrow{OA} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

No.	Answers	Further explanations
24	C	From O to B, move 4 units to the right and 1 unit upwards: $\overrightarrow{OB} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$
25	C	$\left\lvert\overrightarrow{OA}\right\rvert = \sqrt{3^2 + 4^2} = \sqrt{25} = 5$ units
26	B	$\overrightarrow{AO}$ is in the opposite direction of $\overrightarrow{OA} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, so you multiply by –1: $\overrightarrow{AO} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$
27	D	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = \begin{pmatrix} -3 \\ -4 \end{pmatrix} + \begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$
28	C	
29	B	
30	D	
31	B	
32	D	Parallel vectors are scalar multiples of each other. Given the vector $\mathbf{a} - 2\mathbf{b}$, the only parallel vectors are II $2\mathbf{a} - 4\mathbf{b}$, because this can be written as $2(\mathbf{a} - 2\mathbf{b})$. III $-6\mathbf{b} + 3\mathbf{a}$, because this can be written as $3(\mathbf{a} - 2\mathbf{b})$.