

Name:

**Year 10 Mathematics Development
Semester One Examination Revision Assignment
Due: Monday 21st June**

To be completed on file paper. Show ALL working.

Exponential Notation

1. Choose the correct answer.

$\left(\frac{2m^2n^4}{9m^{-3}} \times \frac{4m^3}{8n^2} \right)^{\frac{1}{2}}$ simplifies to:

A $\frac{m^2n}{3}$

B $\frac{6m^4n}{17}$

C $\frac{m^2n}{9}$

D $\frac{m^4n}{3}$

E $\frac{m^8n^2}{9}$

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2. Choose the best answer.

$\sqrt{56}$ can be simplified to:

A $4\sqrt{7}$

B $4\sqrt{14}$

C $2\sqrt{14}$

D $2\sqrt{28}$

E $7\sqrt{8}$

3. Choose the correct answer.

A population is decreasing at a rate of 4% p.a. If the initial population was 120 000, the population after 10 years would be closest to:

- A 48 000
- B 177 629
- C 80 000
- D 115 200
- E 79 780

4. Simplify the following expressions:

a $x^4 \times x^6 \times x^{-3}$

b $(2x^2y^3)^3 \div x^{-2}y^6$

5. Write each of the following in index form:

a $(\sqrt[5]{x})^3$

b $\sqrt[3]{x^2}$

6. Evaluate the following:

a $16^{3/2}$

b $27^{5/3}$

7. Simplify the following expression:

$(a^2b^{-4})^{3/2} \times (a^6b^8)^{5/2}$

8. Calculate the following, correct to two decimal places:

a $\sqrt[4]{83}$

b $7^{-2/5}$

9. Write the following in standard form:

a 5 740 000

b 0.000 078

10. Use your calculator to evaluate the following:

a 3^6

b $16807^{1/5}$

11. Simplify the following expressions:

a $2\sqrt{5} \times 4\sqrt{3}$

b $10\sqrt{8} + 3\sqrt{8}$

12. Write as an entire surd:

a $3\sqrt{7}$

b $2\sqrt{3} \times 3\sqrt{2}$

13. Simplify the following expressions:

a $3\sqrt{125} + 2\sqrt{20}$

b $\frac{5\sqrt{20}}{6\sqrt{5}}$

14. Express each of the following with a rational denominator:

a $\frac{6}{\sqrt{5}}$

b $\frac{2\sqrt{3}}{\sqrt{6}}$

15. Rewrite the following expression with a rational denominator:

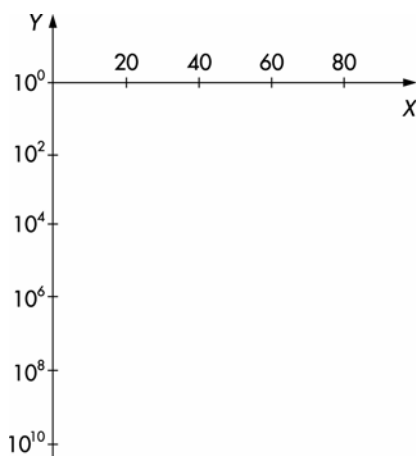
$$\frac{5}{\sqrt{5} - \sqrt{3}}$$

16. The level of a sound is measured in decibels. This is related to the actual intensity of the sound by the formula: $y = 10^{(x/10 - 12)}$. In this formula, x is the level in decibels, and y is the actual intensity.

a Complete this table for the values of x and y .

x	20	40	60
y			

b Use the table to help you plot points to show the relationship on the grid provided below. Note the scale on the vertical axis.



c Describe the relationship between the two variables in the graph.

d The value of $x = 0$ is the lowest sound that can be heard by a human. What is that intensity?

e What change in sound intensity corresponds to an increase of 10 decibels?

f What rise in decibel level (from 60) doubles the intensity of the sound?

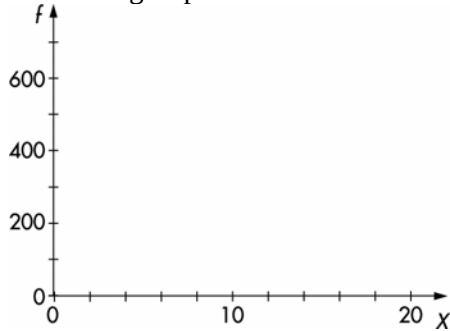
17. The frequency of a sound gives its pitch—whether it sounds high or low. For a guitar the frequency of the open A string is 220. Higher notes can be made on this string using the frets, the small ridges across the finger board. If the frets are numbered from the end of the string, then the higher the fret number, the higher the pitch and the higher the frequency.

The relationship between frequency f and fret number n is $f = 220 \times 2^{(n/12)}$.

a Use your calculator to find the frequencies for the given fret numbers.

n	0	5	7	12	17	19
f						

b Use the grid provided to sketch the graph of the relationship.



c Describe the relationship.

d What is the effect of adding 12 to the fret number? Will this always work?

e The relationship between frequency and string length was first investigated by our good friend Pythagoras. He discovered that halving the string length doubled the frequency. Explain the effect this must have on the position of the frets on a guitar.

18. A super-ball falls from a height of 2 m onto concrete. After each bounce it loses 10% of its previous height, measured to the bottom of the ball.

a Complete the table showing the relationship between the number of bounces (n) and the height (h).

n	0	1	2	3	4	5	6
h							

b Sketch a graph to show the relationship.

c Name the type of relationship in **b**, and state its formula.

d Sketch another graph to show the relationship between each bounce height and the previous bounce height.

e Name the type of relationship in **d**.

f After how many bounces is its height less than half its initial height? (Choose the nearest whole number.)

g When will the ball stop bouncing?

19. Inflation is running at 10.4%. Imagine that it continues for a long time at this rate, and that prices rise with inflation. A can of drink costs \$1 today.

a What will the can of drink cost in 5 years?

b After how many years will the can cost \$2?

c After how many years will the can cost \$4?

d After how many years will the can cost \$8?

e Write a formula for the cost of the drink after a number of years.

f What is the doubling time for 10.4% inflation?

g Prove your answer to **f** using the answer to **e**.

20. Express the following in standard form:

a 2 400 000

b 0.000 006 4

21. Express the following as a basic numeral:

a 6.5×10^5

b 7.1×10^{-8}

22. Simplify the following expressions (give your answers with positive indices):

a $2a^2b \times 3a^5b^2$

b $10a^{13}b^2 \div 2a^3b^4$

23. Simplify the following expressions (give your answers with positive indices):

a $\left(25a^2b^6\right)^{\frac{1}{2}}$

b $\sqrt{p^6q^{-4}}$

24. Evaluate each of the following:

a $49^{\frac{1}{2}}$

b $8^{-\frac{1}{3}}$

25. The planet Pluto is 5.9×10^9 km from the Sun. The distance from the Earth to the Moon is 3.84×10^5 km.

a Write both numbers as basic numerals.

b Assume that the Moon's orbit is a circle. What is the circumference of that circle?

c How many Earth–Moon distances can fit between the Sun and Pluto? Write the answer in standard form.

Trigonometry

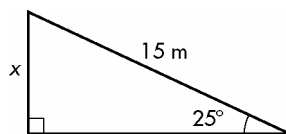
1. Choose the correct answer.

The value of 27.2° in degrees and minutes is:

- A $27^\circ 2'$
- B $27^\circ 20'$
- C $27^\circ 12'$
- D $27^\circ 40'$
- E $27^\circ 80'$

2. Choose the correct answer.

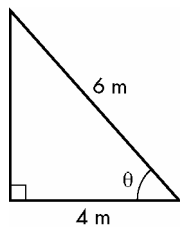
The correct length, to one decimal place, of the side marked X is:



- A 13.6 m
- B 6.3 m
- C 7.0 m
- D 6 cm
- E 2.8 cm

3. Choose the correct answer.

The size of the angle marked θ is:



- A $41^\circ 48'$
- B 33.7°
- C $48^\circ 19'$
- D $33^\circ 41'$
- E $48^\circ 11'$

4. Choose the correct answer.

The bearing 159°T is the same as:

- A $\text{S}21^\circ\text{E}$
 - B $\text{S}21^\circ\text{W}$
 - C $\text{N}159^\circ\text{S}$
 - D $\text{S}159^\circ\text{N}$
 - E $\text{E}21^\circ\text{S}$
-

5. Use your calculator to find:

a $\sin 43^\circ$

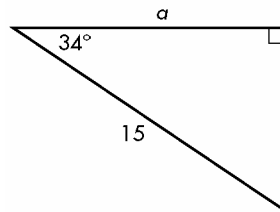
b $\cos 18^\circ 15'$

6. Find the value of x in these expressions:

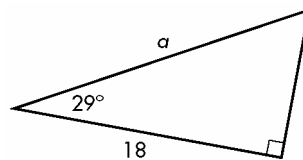
a $\sin x = 0.2871$

b $\cos x = 0.3521$

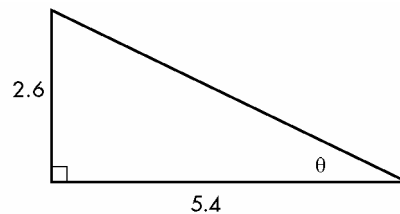
7. Find the value of the pronumeral in this diagram:



8. Find the value of the pronumeral in this diagram:



9. Find the size of the marked angle in this triangle:



10. A wheel chair ramp is 8.5 m long and rises 1.2 m above the horizontal. What is the angle the ramp makes with the horizontal?

11. A ladder reaches 3.1 m up a vertical wall while making an angle of 13° with the wall. How long is the ladder?

12. Keith is standing 12 m from the base of a sky-scraper. How tall is the building if he has to look through an angle of elevation of 78° to see the top? Assume Keith's height is 1.5 m.

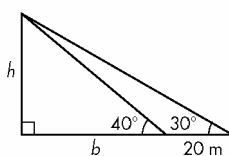
13. A yacht sails 35 km on a bearing of 18°T . How far north is the yacht from its starting position?

14. A hiker walks 7 km due north and then turns and walks 12 km due west. What is the bearing of the hiker from his starting position?

15. What is the angle with the base made by the internal diagonal in a cube with a side length of 10 cm?

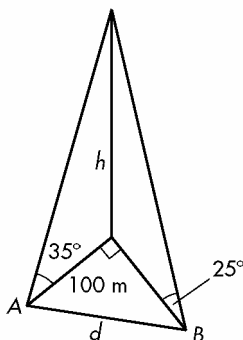
16. A square pyramid with base edges of 12 cm has sloping edges 25 cm long. What angle does the sloping edge make with the base?

17. The diagram below shows two angles of elevation (30° and 40°) of the top of a tower. The points from which the angles are measured are 20 m apart.



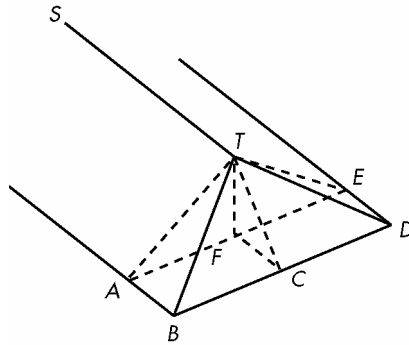
- a Write an equation involving the smaller angle. Express it in a form that gives the base.
 - b Write an equation involving the larger angle. Express it in a form that gives the base.
 - c Equate the two equations above. How high is the tower?
 - d Find the horizontal distances from the base of the tower.
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18. The diagram shows two angles of elevation of a tower. The positions from which the angles are measured form an angle of 90° with the base of the tower. One of the observers (A) is 100 m from the base of the tower in a southerly direction.



- a Find the height of the tower.
 - b Find the distance of the other observer (B) from the base of the tower.
 - c Find the distance between the two observers.
 - d Find the bearing of A from B.
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19. The diagram shows the structure of the end of a gable house roof. The top ridge is ST . The ceiling level is the plane $ABCDEF$. The point F is directly under T , $AF = EF$ and $ABCF$ is a square. BD is 6 m long, and TF is 2.5 m.



- Find the angle between the edges TB and TD .
- Find the angle between the edges TB and TS .
- Find the angle between the planes TAB and TED .
- Find the area of the triangle BTD .

20. Write the following in degrees and minutes.

- 12.5°
- 15.10°

21. Write the following as decimal degrees.

- $10^\circ 20'$
- $43^\circ 54'$

22. Use your calculator to find the following correct to 4 decimal places:

- $\sin 38^\circ$
- $\cos 19^\circ 51'$

23. A cyclist rides 15 km on a bearing of $112^\circ T$. How far east has he travelled?

24. Albert walks 3 km due west then turns and walks 4 km due north. What is his bearing from his starting point?

Algebra

1. A square has a side length of $(x - 3)$ cm. The area of this square is:

A $(x - 3)(x - 3)$

B $x^2 - 9$

C $2(x - 3)$

D $x^2 + 6x + 9$

E $x^2 - 6x - 9$

2. The expansion of $(2x - 3)(2x + 3)$ is:

A $(2x - 3)^2$

B $4x^2 + 9$

C $4x^2$

D $4x$

E $4x^2 - 9$

3. Expand the following expressions:

a $a(3a + 2b)$

b $(x + 2)(x + 6)$

4. Expand and simplify:

a $5(x + 3)(x - 2)$

b $(x - 1)(x + 3)(x - 4)$

5. Factorise the following expressions:

a $4x^2 + 8x$

b $5x^2 + 10xy + 5y^2$

6. Factorise the following:

a $x^2 - 25$

b $4y^2 - 49x^2$

7. Factorise the following expressions:

a $x^2 + 12x + 32$

b $x^2 - 3x - 28$

8. Factorise these expressions:

a $45x^2 - 20$

b $(x + 5)^2 - (x - 4)^2$

9. Factorise this expression:

$6x^2 + 2x - 4$

10. Factorise this expression:

$$x^2 + 10x + 25 - 49y^2$$

11. Factorise this expression:

$$6(x + 1)^2 - (x + 1) - 2$$

12. Complete the square and factorise the following expression:

$$x^2 + 10x - 4$$

13. Simplify the following expression:

$$\frac{x^2 + 4x + 4}{x^2 - 9} \times \frac{x^2 + 6x + 9}{x^2 - 4}$$

14. Simplify the following expression:

$$\frac{x^2 + 4x + 4}{x^2 - 9} \times \frac{x^2 - 6x + 9}{x^2 - 4}$$

15. Simplify the following fraction:

$$\frac{2x^2 - 13x - 24}{x^2 - 2x - 48}$$

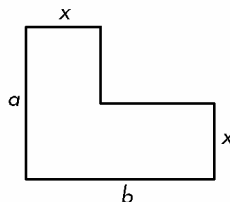
16. Simplify the following expression:

$$\frac{x^2 - 16}{x^2 - 25} \div \frac{x^2 + 8x + 16}{x^2 + 10x + 25}$$

17. Simplify the following expression:

$$\frac{x + 5}{2} + \frac{2x - 4}{5}$$

18. The diagram shows the floor plan of a room; the lengths are in metres. Find the expressions for the area of the carpet as required.



a Write an expression by adding two rectangular areas.

b Write an expression by subtracting two rectangular areas.

c Evaluate both your expressions in **a** and **b** for different, but sensible, values of the variables, and show that they are equivalent.

d Prove that one expression is equal to the other using the laws of algebra.

19. Simplify the following fractions:

a $\frac{3x+9}{3}$

b $\frac{20x-4y}{5ax-ay}$

20. Re-write the following expressions as a single fraction:

a $\frac{x+6}{2} + \frac{x-3}{3}$

b $\frac{2x-3}{2} + \frac{5x+1}{x}$

21. Simplify the following expressions:

a $\frac{3x}{4} \times \frac{2y}{6}$

b $\frac{2x+4}{5} \times \frac{10}{x+2}$

22. Simplify the fraction:

$$\frac{y^2 - 16}{y^2 + 6y + 8}$$

Relationships and Variation

1. Choose the correct answer.

Which of the following expressions is quadratic?

A $y = 3x^2 - 5x$

B $y = 5x^3 - 2x$

C $y = 5x + \frac{1}{x}$

D $y = 2x + 1$

E $y = \sqrt{x}$

2. Choose the correct answer.

The value of the constant of variation in the expression $y = \frac{2}{5x^2}$ is:

A 2

B 5

C $\frac{2}{5}$

D $\frac{2}{25}$

E k

3. Choose the correct answer.

<i>T</i>	1	2	3	4	5
<i>C</i>	4	6	8	10	12

The formula for the above table of values is:

A $C = T + 3$

B $C = 2T + 2$

C $C = 4T + 3$

D $C = 5T - 1$

E $C = 3T - 3$

4. Factorise the following expressions:

a $x^2 - 81$

b $x^2 + 2x - 80$

5. Using the standard form for a quadratic equation, give the value of a , b and c in the following equations:

a $4x^2 + 5x + 6 = 0$

b $10x^2 - 6x - 2 = 0$

6. Write the following in turning point form:

$y = x^2 + 10x + 8$

7. Find the turning point of the following graph:

$y = x^2 + 3x + 1$

8. Give the X- and Y-intercepts of the following graphs:

a $y = x^2 - 3x - 10$

b $y = x^2 - 64$

9. Sketch the graph of $y = (x - 3)^2 + 2$

10. Sketch the graph of $y = -3x^2 + 1$

11. Craig can throw a tennis ball so that its path is given by the equation

$h = -x(x - 5)$.

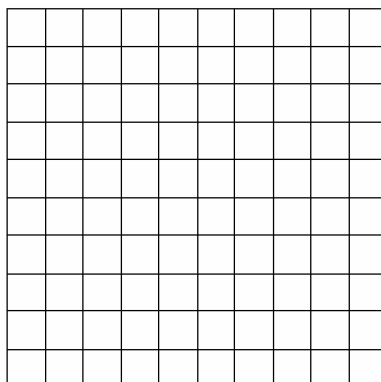
What is the highest level the tennis ball reaches?

12. The equation $y = 6x - x^2$ gives the height (y) of a ball from ground level, up into the air, and back down again to the same level from which it started. The x -values give the time in seconds.

a Complete this table for the values of x and y .

x	0	1	2	3	4	5	6	7
y								

b Use the table to help you plot points to show the path of the ball on the grid provided below.



c Name the turning point of the graph.

d Name the X- and Y-intercepts of the graph.

e Find, to two decimal places, both the values of x that make $y = 6$. Use any method.

f Explain what is meant by the solutions you have found in **e**.

g Explain why there are no solutions when $y = 12$.

13. The path of the water from a fire-hose follows a path given by $y = -2(x - 1)^2 + 8$.

a Is this relationship linear or quadratic? How do you know?

b Sketch a graph of the path of the water. Include the turning point, and the X- and Y-intercepts.

c Solve the equation $x = 0$. What does this solution mean?

d Solve the equation $y = 6$. What do these solutions mean?

e What is the highest point reached by the water?

f Explain why you cannot find a solution to the equation $y = 10$.

14. **a** In the space below, sketch a graph of the function $y = (x + 2)(x - 4)$. Mark the X- and Y-intercepts and the turning point.

b For what values of p or q is this true? 'The graph of $y = (x - p)(x - q)$ will pass through the origin.' Give reasons.

15. After t seconds, the height of a brick dropped from height y is given by $y = 20 - 5t^2$.
- What is the initial height of the brick?
 - When does it hit the ground?
 - In the space below, sketch a graph of the function above. Mark the T - and Y -intercepts and the turning point.
 - At the same time as the brick is dropped, a ball is kicked from 20 metres away at an angle of 45° . Its path is given by $y = 5t(2 - t)$. As well as going up and down, it heads straight for the brick at a horizontal speed of 10 m/s. Sketch its path on the same axes.
 - Do the ball and brick ever hit?

16. If $y = 10$ and $x = 5$ find the value of k if:

a $y = kx$

b $y = \frac{k}{x}$

17. Find the formula that connects the following table of values:

x	0	1	2	3
y	0		4	8
				12

18. y varies directly as x . If $y = 10$ when $x = 4$, what does y equal when $x = 15$?

19. The cost of carpeting a house varies directly with the area of the floor.
If it costs \$2700.00 to carpet an area of 120 sq m, how much will it cost to carpet an area of 80 sq m?

20. The volume of gas in a spherical balloon varies directly as the cube of the radius. Find the radius that gives a volume of 1000 cm^3 if the volume is 800 cm^3 when the radius is 5.75 cm.

21. Find the formula that connects the following table of values:

x	1	2	4	5
y	10		5	2.5
				2

22. The values of y and x are related by the formula $y = \frac{x^2}{4}$

- a Complete this table to show the relationship between x and y for several integer values.

x	0	1	2	3	4
y					

- Sketch a graph to show the form of the relationship.
- Find y for $x = 1.5$.
- Find x for $y = 10$.
- If x increases by 10%, what is the effect on y ?
- Describe and name the type of relationship between x and y .

23. The values of y and x are related by the formula $y = \frac{24}{x}$.

a Complete this table to show the relationship between x and y for several integer values.

x	1	2	3	4
y				

b Sketch a graph to show the form of the relationship.

c Find y for $x = 1.5$.

d Find x for $y = 2.5$.

e If x increases by 10%, what is the effect on y ?

f Describe and name the type of relationship between x and y .

g Why is it not possible to find a y -value for $x = 0$?

24. The table gives the time (in Earth years) for one revolution of several planets around the Sun. In addition it gives the average radius of the orbit, using units for which the orbit of Earth is 1.

Planet	Time (years) t	Radius r
Mercury	0.242	0.388
Venus	0.613	0.722
Earth	1	1
Mars	1.883	1.525
Jupiter	11.88	5.207
Saturn	29.49	9.545

a Use all the data in the table to sketch a graph of the relationship between t and r .

b Could your graph show direct variation? Explain.

c Calculate the values of $r^{1.5}$, for Mercury, Earth and Jupiter.

d Sketch a graph of the three pairs of $(t, r^{1.5})$ values. Does it show direct linear variation?

e State the relationship between t and $r^{1.5}$.

f Test the relationship in **e** on the data for Saturn.

25. A brick is dropped from a window near the top of a high-rise building. The distance it has fallen after several seconds is given in the table.

time (seconds)	x	0	1	2	3
distance (m)	y	0	5	20	45

a Sketch a graph to show the relationship.

b Assuming that the relationship is of the type $y = kx^n$, predict a value for n .

c Using your predicted value for n , work out the values of $\frac{y}{x^n}$ from the table. Continue until you have found the correct value for n .

d Write the correct formula for the values in the table.
