EXAM PAPERS PRACTICE

Algebra

Model Answers

Question 1

Make x the subject of the formula.

$y = \sqrt{x^2 + 1}$ [3]

1. Square both sides of the equation to eliminate the square root:

$y^2 = x^2 + 1$

2. Subtract 1 from both sides:

$y^2 - 1 = x^2$

3. Take the square root of both sides:

$x = \sqrt{y^2 - 1}$

So, the expression for x in terms of y is $x = \sqrt{y^2 - 1}$.

Question 2

$y = p^2 + qr$

(a) Find y when $p = -5$, $q = 3$ and $r = -7$. [2]

To find the value of y when $p = -5, q = 3$, and $r = -7$ in the equation $y = p^2 + qr$, substitute these values into the equation:

$y = (-5)^2 + (3)(-7)$

Now, calculate each term:

$y = 25 - 21$

Finally, simplify the expression:

$y = 4$

Therefore, when $p = -5, q = 3$, and $r = -7$, the value of y is 4 .

(b) Write p in terms of q, r and y.

$y = p^2 + qr$

1. Subtract qr from both sides to isolate p^2 : [2]

$y - qr = p^2$

1. Take the square root of both sides:

$p = \sqrt{y - qr}$

So, p in terms of q, r, and y is $p = \sqrt{y - qr}$.

Question 3

Make b the subject of the formula.

[3]

$$c = \sqrt{a^2 + b^2}$$

1. Square both sides of the equation to eliminate the square root:
$c^2 = a^2 + b^2$
2. Subtract a^2 from both sides:
$b^2 = c^2 - a^2$
3. Take the square root of both sides:
$b = \sqrt{c^2 - a^2}$
So, the expression for b in terms of a, c is $b = \sqrt{c^2 - a^2}$.

Question 4

Simplify the expression.

$$(a^{\frac{1}{2}} - b^{\frac{1}{2}})(a^{\frac{1}{2}} + b^{\frac{1}{2}})$$

[2]

To simplify the given expression $\left(a^{\frac{1}{2}} - b^{\frac{1}{2}}\right)\left(a^{\frac{1}{2}} + b^{\frac{1}{2}}\right)$, you can use the difference of squares formula, which states that $(x-y)(x+y) = x^2 - y^2$.
Apply this formula to the given expression:
$\left(a^{\frac{1}{2}}\right)^2 - \left(b^{\frac{1}{2}}\right)^2$
Simplify the squares:
$a - b$
So, the simplified expression is $a - b$.

Question 5

Rearrange the formula $y = \frac{x+2}{x-4}$ to make x the subject. [4]

1. Cross-multiply to eliminate the fraction:
$y(x-4) = x+2$
2. Distribute y on the left side:
$yx - 4y = x + 2$
3. Move all terms involving x to one side and constants to the other side:
$yx - x = 4y + 2$
4. Factor out x on the left side:
$x(y-1) = 4y+2$
5. Divide by $(y-1)$ to solve for x :
$x = \frac{4y+2}{y-1}$

So, the formula rearranged to make x the subject is $x = \frac{4y+2}{y-1}$.

Question 6

Make w the subject of the formula.

[4]

$$c = \frac{4+w}{w+3}$$

1. Multiply both sides by $(w+3)$ to eliminate the fraction:
$c(w+3) = 4+w$
2. Distribute c on the left side:
$cw + 3c = 4 + w$
3. Move all terms involving w to one side and constants to the other side:
$cw - w = 4 - 3c$
4. Factor out w on the left side:
$w(c-1) = 4-3c$
5. Divide by $(c-1)$ to solve for w :
$w = \frac{4-3c}{c-1}$

So, the formula rearranged to make w the subject is $w = \frac{4-3c}{c-1}$.

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Question 7

$$w = \frac{I}{\sqrt{LC}}$$

(a) Find w when $L = 8 \times 10^{-3}$ and $C = 2 \times 10^{-9}$. [3]
Give your answer in standard form.

The formula given is $w = \frac{1}{\sqrt{LC}}$, where w is the angular frequency, I is the current, L is the inductance, and C is the capacitance.
Given values: $L = 8 \times 10^{-3}$ and $C = 2 \times 10^{-9}$.
Substitute these values into the formula:
$w = \frac{I}{\sqrt{(8\times10^{-3})(2\times10^{-9})}}$
First, simplify the expression under the square root:
$w = \frac{I}{\sqrt{1.6\times10^{-11}}}$
Now, express the square root in standard form:
$w = \frac{I}{1.2649\times10^{-6}}$
To give the answer in standard form, you can express the denominator with the appropriate power of 10:
$w \approx \frac{I}{1.265\times10^{-6}}$
So, w in standard form is approximately $w \approx \frac{I}{1.265\times10^{-6}}$.

(b) Rearrange the formula to make C the subject. [3]

1. Square both sides to eliminate the square root:
$w^2 = \frac{I^2}{LC}$
1. Multiply both sides by LC to isolate C :
$C = \frac{I^2}{w^2}$
So, the formula rearranged to make C the subject is $C = \frac{I^2}{w^2}$.
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Question 8

$$ap = px + c$$

Write p in terms of a, c and x.

[3]

$ap = px + c$

1. Subtract px from both sides:

$ap - px = c$

1. Factor out p on the left side:

$p(a - x) = c$

1. Divide by $(a - x)$ to solve for p :

$p = \frac{c}{a-x}$

So, p in terms of a, c, and x is $p = \frac{c}{a-x}$.

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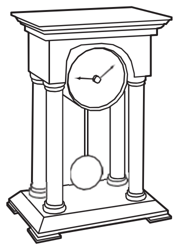
Question 9



The length of time, T seconds, that the pendulum in the clock takes to swing is given by the formula

$$T = \frac{6}{\sqrt{(1+g^2)}}.$$

Rearrange the formula to make g the subject. [4]

1. Square both sides of the equation to eliminate the square root:

$T^2 = \frac{36}{1+g^2}$

1. Cross-multiply to get rid of the fraction:

$T^2\left(1+g^2\right) = 36$

1. Distribute T^2 on the left side:

$T^2 + T^2g^2 = 36$

1. Rearrange the terms:

$T^2g^2 = 36 - T^2$

1. Divide by T^2 to solve for g^2 :

$g^2 = \frac{36-T^2}{T^2}$

1. Take the square root of both sides:

$g = \sqrt{\frac{36-T^2}{T^2}}$

So, the formula rearranged to make g the subject is $g = \sqrt{\frac{36-T^2}{T^2}}$.

Question 10

(a) $3^x = \frac{1}{3}$.

Write down the value of x. [1]

To find the value of x in the equation $3^x = \frac{1}{5}$, we can take the logarithm of both sides. In this case, let's use the natural logarithm (ln):

$\ln\left(3^x\right) = \ln\left(\frac{1}{5}\right)$

Use the logarithm property $\ln\left(a^b\right) = b\ln(a)$:

$x\ln(3) = \ln\left(\frac{1}{5}\right)$

Now, solve for x :

$x = \frac{\ln\left(\frac{1}{5}\right)}{\ln(3)}$

Using a calculator:

$x \approx -1.46447$

So, the value of x is approximately -1.46447 .

(b) $5^y = k$.

Find 5^{y+1}, in terms of k.

Given the equation $5^y = k$, we want to find 5^{y+1} in terms of k.

First, let's express 5^{y+1} in terms of 5^y :

$5^{y+1} = 5^y \times 5^1$

Now, substitute $5^y = k$:

$5^{y+1} = k \times 5$

So, in terms of k, 5^{y+1} is $5k$.

Question 11

Make y the subject of the formula. $A = \frac{r(y+2)}{5}$ [3]

1. Multiply both sides by 5 to get rid of the fraction:
$5A = r(y+2)$
1. Divide both sides by r to isolate $y+2$:
$\frac{5A}{r} = y+2$
1. Subtract 2 from both sides to solve for y :
$y = \frac{5A}{r} - 2$
So, the formula with y as the subject is $y = \frac{5A}{r} - 2$.

Question 12

Simplify $16 - 4(3x - 2)^2$. [3]

1. First, apply the square to the expression inside the parentheses:
$16 - 4\left(9x^2 - 12x + 4\right)$
1. Distribute the -4 to each term inside the parentheses:
$16 - 36x^2 + 48x - 16$
1. Combine like terms:
$-36x^2 + 48x$
So, the simplified expression is $-36x^2 + 48x$.

Question 13

Rearrange the formula to make y the subject.

$$x + \frac{\sqrt{y}}{9} = 1$$ [3]

1. Subtract x from both sides:

$\frac{\sqrt{y}}{9} = 1 - x$

1. Multiply both sides by 9 to isolate the square root term:

$\sqrt{y} = 9(1 - x)$

1. Square both sides to eliminate the square root:

$y = (9(1 - x))^2$

1. Simplify the expression on the right side:

$y = 81(1 - x)^2$

So, the formula rearranged to make y the subject is $y = 81(1 - x)^2$.

Question 14

(a) Factorise $ax^2 + bx^2$. [1]

$ax^2 + bx^2 = x^2(a + b)$

So, the factored form of $ax^2 + bx^2$ is $x^2(a + b)$.

(b) Make x the subject of the formula $ax^2 + bx^2 - d^2 = p^2$. [2]

$ax^2 + bx^2 - d = p$

Combine like terms:

$(a + b)x^2 - d = p$

Add d to both sides:

$(a + b)x^2 = p + d$

Divide both sides by $(a + b)$ to isolate x^2 :

$x^2 = \frac{p+d}{a+b}$

Now, take the square root of both sides:

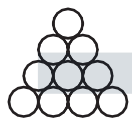
$x = \pm\sqrt{\frac{p+d}{a+b}}$

So, x as the subject of the formula is $x = \pm\sqrt{\frac{p+d}{a+b}}$.

Question 15

Two quantities c and d are connected by the formula $c = 2d + 30$. [1]
Find c when $d = -100$.

To find c when $d = -100$ using the formula $c = 2d + 30$, substitute the given value of d into the equation:
$c = 2(-100) + 30$
Now, perform the calculations:
$c = -200 + 30$
$c = -170$
So, when $d = -100$, the value of c is -170 .



Question 16

The number of tennis balls (T) in the diagram is given by the formula

$$T = \frac{1}{2} n (n+1),$$

where n is the number of rows.
The diagram above has 4 rows.
How many tennis balls will there be in a diagram with 20 rows? [1]

You're given the formula for the number of tennis balls (T) in the diagram based on the number of rows (n) :
$T = \frac{1}{2}n(n+1)$
You're told that the diagram above has 4 rows, so you can substitute $n = 4$ into the formula to find the number of tennis balls for this case:
$T = \frac{1}{2} \times 4 \times (4+1) = \frac{1}{2} \times 4 \times 5 = 10$
So, there are 10 tennis balls in a diagram with 4 rows.
Now, if you want to find the number of tennis balls for a diagram with 20 rows, substitute $n = 20$ into the formula:
$T = \frac{1}{2} \times 20 \times (20+1) = \frac{1}{2} \times 20 \times 21 = 210$
Therefore, there will be 210 tennis balls in a diagram with 20 rows.

Question 17

Make d the subject of the formula

$$c = \frac{d^3}{2} + 5 .$$

[3]

$c = \frac{d^3}{2} + 5$

1. Subtract 5 from both sides:

$\frac{d^3}{2} = c - 5$

1. Multiply both sides by 2 to get rid of the fraction:

$d^3 = 2(c - 5)$

1. Take the cube root of both sides to solve for d :

$d = \sqrt[3]{2(c-5)}$

So, the formula with d as the subject is $d = \sqrt[3]{2(c-5)}$.

Question 18

Make c the subject of the formula

$$\sqrt{3c - 5} = b.$$

[3]

$\sqrt{3c - 5} = b$

1. Square both sides to eliminate the square root:

$(\sqrt{3c-5})^2 = b^2$

$3c - 5 = b^2$

1. Add 5 to both sides:

$3c = b^2 + 5$

1. Divide both sides by 3 to solve for c :

$c = \frac{b^2+5}{3}$

So, the formula with c as the subject is $c = \frac{b^2+5}{3}$.

Question 19

Make d the subject of the formula

$$c = kd^2 + e.$$ [3]

$c = kd^2 + e$

1. Subtract e from both sides:

$c - e = kd^2$

1. Divide both sides by k to solve for d^2 :

$d^2 = \frac{c-e}{k}$

1. Take the square root of both sides to solve for d :

$d = \sqrt{\frac{c-e}{k}}$

So, the formula with d as the subject is $d = \sqrt{\frac{c-e}{k}}$.

EXAM PAPERS PRACTICE

Question 20

Calculate the radius of a sphere with volume 1260 cm^3.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.] [3]

$V = \frac{4}{3}\pi r^3$

You're given that the volume is 1260 cm^3, so you can set up the equation:

$1260 = \frac{4}{3}\pi r^3$

To solve for r, you can follow these steps:

1. Multiply both sides by $\frac{3}{4}$ to isolate the term with r^3 :

$\frac{3}{4} \times 1260 = \pi r^3$

$945 = \pi r^3$

1. Divide both sides by π to isolate r^3 :

$r^3 = \frac{945}{\pi}$

1. Take the cube root of both sides to solve for r :

$r = \sqrt[3]{\frac{945}{\pi}}$

Now, you can calculate the numerical value:

$r \approx \sqrt[3]{\frac{945}{\pi}} \approx 6$ cm

So, the radius of the sphere is approximately 6 cm.

Question 21

Rearrange the formula $c = \frac{4}{a - b}$ to make a the subject. [3]

$c = \frac{4}{a-b}$

1. Cross-multiply to eliminate the fraction:

$c(a - b) = 4$

1. Distribute c on the left side:

$ca - cb = 4$

1. Add cb to both sides:

$ca = cb + 4$

1. Divide both sides by c to solve for a :

$a = \frac{cb+4}{c}$

So, the formula rearranged to make a the subject is:

$a = \frac{cb+4}{c}$

Question 22

Make x the subject of the formula. $y = \frac{x}{3} + 5$ [2]

$y = \frac{x}{3} + 5$

1. Subtract 5 from both sides:

$y - 5 = \frac{x}{3}$

1. Multiply both sides by 3 to isolate x :

$3(y - 5) = x$

1. Distribute 3 on the left side:

$3y - 15 = x$

So, the formula with x as the subject is:

$x = 3y - 15$

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Question 23

Expand the brackets and simplify.

$$\frac{1}{2}(6x - 2) - 3(x - 1)$$ [2]

1. Distribute $\frac{1}{2}$ to both terms inside the first set of brackets:

$\frac{1}{2} \times 6x - \frac{1}{2} \times 2 - 3(x - 1)$

This simplifies to $3x - 1 - 3(x - 1)$.

2. Distribute -3 to both terms inside the second set of brackets:

$3x - 1 - 3x + 3$

3. Combine like terms:

$3x - 3x - 1 + 3$

This further simplifies to $-1 + 3$.

4. Finally, combine the constants:

$-1 + 3 = 2$

So, the simplified expression is 2 .

Question 24

Make x the subject of $y = \frac{(x+3)^2}{5}$. [3]

$y = \frac{(x+3)^2}{5}$

1. Multiply both sides by 5 to eliminate the fraction:

$5y = (x+3)^2$

1. Take the square root of both sides:

$\sqrt{5y} = x + 3$

1. Subtract 3 from both sides to isolate x :

$x = \sqrt{5y} - 3$

So, the formula with x as the subject is:

$x = \sqrt{5y} - 3$

$\because \mathbb{D}$

Question 25

Rearrange the formula $J = mv - mu$ to make m the subject. [2]

$J = mv - mu$

1. Factor out m from the right side:

$J = m(v-u)$

1. Divide both sides by $(v-u)$ to solve for m :

$m = \frac{J}{v-u}$

So, the formula rearranged to make m the subject is:

$m = \frac{J}{v-u}$

Question 26

$$\frac{g}{2} = \sqrt{\frac{h}{i}}$$

Find i in terms of g and h. [3]

1. Square both sides to eliminate the square root:

$\left(\frac{g}{2}\right)^2 = \frac{h}{i}$

$\frac{g^2}{4} = \frac{h}{i}$

2. Multiply both sides by i to isolate i :

$i \cdot \frac{g^2}{4} = h$

3. Multiply both sides by $\frac{4}{g^2}$ to solve for i :

$i = \frac{4h}{g^2}$

So, i in terms of g and h is $i = \frac{4h}{g^2}$.

Question 27

Make d the subject of the formula $c = \frac{5d + 4w}{2w}$. [3]

$c = \frac{5d+4w}{2w}$

1. Multiply both sides by $2w$ to eliminate the fraction:

$2wc = 5d + 4w$

1. Subtract $4w$ from both sides:

$2wc - 4w = 5d$

1. Factor out d on the right side:

$d = \frac{2wc-4w}{5}$

So, the formula with d as the subject is:

$d = \frac{2wc-4w}{5}$

EXAM PAPERS PRACTICE

Question 28

Make x the subject of the formula.

$$P = \frac{x + 3}{x}$$ [4]

$P = \frac{x+3}{x}$

1. Cross-multiply to eliminate the fraction:

$Px = x + 3$

1. Subtract x from both sides:

$Px - x = 3$

1. Factor out x on the left side:

$x(P - 1) = 3$

1. Divide by $(P - 1)$ to solve for x :

$x = \frac{3}{P-1}$

So, the formula with x as the subject is:

$x = \frac{3}{P-1}$

Question 29

Expand and simplify $2(x - 3)^2 - (2x - 3)^2$. [3]

1. Expand $(x - 3)^2$:

$2(x - 3)^2 = 2\left(x^2 - 6x + 9\right)$

$= 2x^2 - 12x + 18$

2. Expand $(2x - 3)^2$:

$(2x - 3)^2 = (2x - 3)(2x - 3)$

$= 4x^2 - 12x + 9$

3. Substitute these expansions into the original expression:

$2(x - 3)^2 - (2x - 3)^2 = 2x^2 - 12x + 18 - \left(4x^2 - 12x + 9\right)$

4. Distribute the negative sign and combine like terms:

$= 2x^2 - 12x + 18 - 4x^2 + 12x - 9$

$= -2x^2 + 9$

So, $2(x - 3)^2 - (2x - 3)^2 = -2x^2 + 9$.

Question 30

$V = \frac{1}{3}Ah$

(a) Find V when $A = 15$ and $h = 7$. [1]

To find V when $A = 15$ and $h = 7$ using the formula $V = \frac{1}{3}Ah$, substitute the given values into the formula:

$V = \frac{1}{3}(15)(7)$

Now, perform the calculations:

$V = \frac{1}{3}(105)$

Multiply the fraction and the number:

$V = \frac{105}{3}$

Simplify the fraction:

$V = 35$

So, when $A = 15$ and $h = 7$, the value of V is 35 .

(b) Make h the subject of the formula. [2]

$V = \frac{1}{3}Ah$

1. Multiply both sides by $\frac{3}{A}$ to eliminate the fraction:

$\frac{3V}{A} = h$

1. So, the formula with h as the subject is:

$h = \frac{3V}{A}$

Question 31

Rearrange the formula to make x the subject. [2]

$$y = x^2 + 4$$

$y = x^2 + 4$

1. Subtract 4 from both sides:

$y - 4 = x^2$

1. Take the square root of both sides:

$\sqrt{y-4} = x$

However, note that when taking the square root, there will be two possible solutions (positive and negative). Therefore, the formula with x as the subject is:

$x = \pm\sqrt{y-4}$

So, x can be expressed as $x = \sqrt{y-4}$ or $x = -\sqrt{y-4}$.

Question 32

(a) Expand and simplify $(a + b)^2$. [2]

$(a+b)^2 = a^2 + 2ab + b^2$
So,
$(a+b)^2 = a^2 + 2ab + b^2$
This is the expanded and simplified form of $(a+b)^2$.

(b) Find the value of $a^2 + b^2$ when $a + b = 6$ and $ab = 7$.

$a^2 + b^2 = (a+b)^2 - 2ab$
Given that $a + b = 6$ and $ab = 7$, substitute these values into the identity:
$a^2 + b^2 = (6)^2 - 2(7)$
$= 36 - 14$
$= 22$
So, the value of $a^2 + b^2$ is 22 .

Question 33

15 A sphere has a volume of $80\,cm^3$.

Calculate the radius of the sphere.
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.] [3]

$V = \frac{4}{3}\pi r^3$
You're given that the volume is 80 cm^3, so you can set up the equation:
$80 = \frac{4}{3}\pi r^3$
To solve for r, you can follow these steps:
1. Multiply both sides by $\frac{3}{4}$ to isolate the term with r^3 :
$\frac{3}{4} \times 80 = \pi r^3$
$60 = \pi r^3$
1. Divide both sides by π to isolate r^3 :
$r^3 = \frac{60}{\pi}$
1. Take the cube root of both sides to solve for r :
$r = \sqrt[3]{\frac{60}{\pi}}$
Now, you can calculate the numerical value:
$r \approx \sqrt[3]{\frac{60}{\pi}} \approx 2.87$ cm
So, the radius of the sphere is approximately 2.87 cm.

EXAM PAPERS PRACTICE

Question 34

(a)

$$y = \sqrt{8 + \frac{4}{x}}$$

Find y when $x = 2$.
Give your answer correct to 4 decimal places. [2]

To find the value of y when $x = 2$ in the equation $y = \sqrt{8 + \frac{4}{x}}$, substitute $x = 2$ into the equation:

$y = \sqrt{8 + \frac{4}{2}}$

Now, perform the calculations:

$y = \sqrt{8 + 2}$

$y = \sqrt{10}$

$y \approx 3.1623$

So, when $x = 2$, the value of y is approximately 3.1623 (correct to 4 decimal places).

(b) Rearrange $y = \sqrt{8 + \frac{4}{x}}$ to make x the subject. [4]

$y = \sqrt{8 + \frac{4}{x}}$

1. Square both sides to eliminate the square root:

$y^2 = 8 + \frac{4}{x}$

2. Subtract 8 from both sides:

$y^2 - 8 = \frac{4}{x}$

3. Take the reciprocal of both sides:

$\frac{1}{y^2 - 8} = \frac{x}{4}$

4. Multiply both sides by $\frac{4}{1}$ to solve for x :

$x = \frac{4}{y^2 - 8}$

So, the formula with x as the subject is:

$x = \frac{4}{y^2 - 8}$

EXAM PAPERS PRACTICE

Question 35

Expand the brackets.

$$y(3 - y^3)$$

[2]

$$y\left(3 - y^3\right) = 3y - y^4$$

So, the expanded form is $3y - y^4$.

Question 36

Make y the subject of the formula.

$$A = \pi x^2 - \pi y^2$$

[3]

To make y the subject of the formula $A = \pi x^2 - \pi y^2$, you need to isolate y on one side of the equation. Follow these steps:

$$A = \pi x^2 - \pi y^2$$

$$\pi y^2 = \pi x^2 - A \quad \left(\text{Isolate the term with } y^2 \text{ on one side}\right)$$

$$y^2 = \frac{\pi x^2 - A}{\pi} \quad \left(\text{Divide both sides by } \pi\right)$$

$$y = \sqrt{\frac{\pi x^2 - A}{\pi}} \quad (\text{Take the square root of both sides})$$

So, the formula for y is:

$$y = \sqrt{\frac{\pi x^2 - A}{\pi}}$$

Question 37

Find r when $(5)^{\frac{r}{3}} = 125$. [2]

$5^{\frac{r}{3}} = 5^3$

Now, since the bases are the same, you can equate the exponents:

$\frac{r}{3} = 3$

To solve for r, multiply both sides of the equation by 3 :

$r = 3 \times 3 = 9$

So, $r = 9$ is the solution to the given equation.

Question 38

Make w the subject of the formula. [3]

$$t = 2 - \frac{3w}{a}$$

$t = 2 - \frac{3w}{a}$

First, subtract 2 from both sides:

$t - 2 = -\frac{3w}{a}$

Next, multiply both sides by $-\frac{a}{3}$ to solve for w :

$w = \frac{a}{3}(2 - t)$

So, the formula for w in terms of t and a is:

$w = \frac{a}{3}(2 - t)$

Question 39

$$T = 2\pi\sqrt{\frac{l}{g}}$$

(a) Find T when $g = 9.8$ and $\ell = 2$. [2]

$T = 2\pi\sqrt{\frac{l}{g}}$

Here, l is the length of the pendulum, and g is the acceleration due to gravity.

Given that $g = 9.8$ and $\ell = 2$, you can substitute these values into the formula and solve for T :

$T = 2\pi\sqrt{\frac{2}{9.8}}$

Now, calculate the expression inside the square root:

$\frac{2}{9.8} \approx 0.204$

Substitute this back into the original equation:

$T = 2\pi\sqrt{0.204}$

Now, calculate the square root:

$T \approx 2\pi\sqrt{0.204} \approx 2\pi \times 0.451$

Finally, calculate the product:

$T \approx 2\pi \times 0.451 \approx 2.83$ seconds

So, when $g = 9.8$ and $\ell = 2$, the period (T) of the pendulum is approximately 2.83 seconds.

(b) Make g the subject of the formula. [3]

$T = 2\pi\sqrt{\frac{l}{g}}$

First, divide both sides of the equation by 2π to isolate the square root term:

$\frac{T}{2\pi} = \sqrt{\frac{l}{g}}$

Next, square both sides of the equation to eliminate the square root:

$\left(\frac{T}{2\pi}\right)^2 = \frac{l}{g}$

Now, solve for g by taking the reciprocal of both sides:

$g = \frac{l}{\left(\frac{T}{2\pi}\right)^2}$

Simplify the expression:

$g = \frac{4\pi^2 l}{T^2}$

So, the formula for g in terms of T and l is:

$g = \frac{4\pi^2 l}{T^2}$

EXAM PAPERS PRACTICE

Question 40

Find the value of $5a - 3b$ when $a = 7$ and $b = -2$. [2]

$5a - 3b = 5(7) - 3(-2)$

Now, perform the multiplication and subtraction:

$5(7) - 3(-2) = 35 + 6 = 41$

So, when $a = 7$ and $b = -2$, the value of $5a - 3b$ is 41 .

Question 41

Make q the subject of the formula $p = 2q^2$. [2]

$p = 2q^2$

First, divide both sides of the equation by 2 :

$\frac{p}{2} = q^2$

Now, take the square root of both sides. Note that there are two possible solutions (positive and negative) for the square root:

$\pm\sqrt{\frac{p}{2}} = q$

So, q can be expressed as:

$q = \pm\sqrt{\frac{p}{2}}$

Therefore, q is the square root of half of p, and it can be either positive or negative.

Question 42

Make a the subject of the formula. $x = y + \sqrt{a}$ [2]

$x = y + \sqrt{a}$

Subtract y from both sides of the equation:

$x - y = \sqrt{a}$

Square both sides to eliminate the square root:

$(x - y)^2 = a$

So, the formula for a in terms of x and y is:

$a = (x - y)^2$

Therefore, a is equal to the square of the difference between x and y.

Question 43

$s = ut + 16t^2$ [2]

Find the value of s when $u = 2$ and $t = 3$.

$s = (2)(3) + 16(3)^2$

Now, perform the calculations:

$s = 6 + 16(9)$

$s = 6 + 144$

$s = 150$

So, when $u = 2$ and $t = 3$, the value of s is 150 .

Question 44

$y = \frac{qx}{p}$

Write x in terms of p, q and y. [2]

$y = \frac{qx}{p}$

Multiply both sides by p to get rid of the fraction:

$py = qx$

Now, divide both sides by q to isolate x :

$x = \frac{py}{q}$

So, x in terms of p, q, and y is:

$x = \frac{py}{q}$

Question 45

Make p the subject of the formula. [3]

$$rp + 5 = 3p + 8r$$

$rp + 5 = 3p + 8r$

First, move all terms involving p to one side of the equation and the constants to the other side:

$rp - 3p = 8r - 5$

Factor out p from the left side:

$p(r - 3) = 8r - 5$

Now, divide both sides by $(r - 3)$ to solve for p :

$p = \frac{8r-5}{r-3}$

So, p is the subject of the formula and can be expressed as:

$p = \frac{8r-5}{r-3}$

Question 46

Solve the equation. [2]

$$6(y + 1) = 9$$

$6(y + 1) = 9$

First, distribute the 6 to both terms inside the parentheses:

$6y + 6 = 9$

Next, subtract 6 from both sides of the equation to isolate the term with y :

$6y = 3$

Finally, divide both sides by 6 to solve for y :

$y = \frac{3}{6} = \frac{1}{2}$

So, the solution to the equation is $y = \frac{1}{2}$.

Question 47

Make x the subject of the formula.

$$y = ax^2 + b$$ [3]

$y = ax^2 + b$
Subtract b from both sides:
$y - b = ax^2$
Divide both sides by a to isolate x^2 :
$\frac{y-b}{a} = x^2$
Now, take the square root of both sides. Note that there are two possible solutions (positive and negative) for the square root:
$x = \pm\sqrt{\frac{y-b}{a}}$
So, x can be expressed as:
$x = \sqrt{\frac{y-b}{a}} \quad \text{or} \quad x = -\sqrt{\frac{y-b}{a}}$
Therefore, x is the square root of the quantity $\frac{y-b}{a}$, and it can be either positive or negative.

Question 48

Simplify.

$$1 - 2u + u + 4$$ [2]

$1 - 2u + u + 4$
Combine the u terms:
$1 - u + 4$
Combine the constants:
$5 - u$
So, the simplified expression is $5 - u$.

Question 49

Make r the subject of this formula.

$$v = \sqrt[3]{p + r}$$ [2]

$v = \sqrt[3]{p+r}$

Cube both sides to eliminate the cube root:

$v^3 = p + r$

Subtract p from both sides to isolate r :

$r = v^3 - p$

So, r is the subject of the formula and can be expressed as:

$r = v^3 - p$

Question 50

Make x the subject of the formula.

$$y = 2 + \sqrt{x - 8}$$ [3]

$y = 2 + \sqrt{x - 8}$

Subtract 2 from both sides:

$y - 2 = \sqrt{x - 8}$

Now, square both sides to eliminate the square root:

$(y - 2)^2 = x - 8$

Expand the left side:

$y^2 - 4y + 4 = x - 8$

Add 8 to both sides:

$y^2 - 4y + 12 = x$

So, x is the subject of the formula and can be expressed as:

$x = y^2 - 4y + 12$

EXAM PAPERS PRACTICE

Question 51

$$y = \frac{2}{x^2} + \frac{x^2}{2}$$

Find the value of y when $x = 6$.
Give your answer as a mixed number in its simplest form. [2]

To find the value of y when $x = 6$ in the equation $y = \frac{2}{x^2} + \frac{x^2}{2}$, substitute $x = 6$:

$y = \frac{2}{6^2} + \frac{6^2}{2}$

Now, simplify each term:

$y = \frac{2}{36} + \frac{36}{2}$

Reduce the fraction:

$y = \frac{1}{18} + 18$

To combine the fractions, find a common denominator:

$y = \frac{1}{18} + \frac{18 \times 18}{18}$

Now, add the fractions:

$y = \frac{1+18^2}{18}$

Calculate the numerator:

$y = \frac{1+324}{18}$

$y = \frac{325}{18}$

Express this as a mixed number in its simplest form:

$y = 18\frac{1}{18}$ [3]

So, when $x = 6$, the value of y is $18\frac{1}{18}$.

Question 52

7 Make x the subject of the formula.

$$y = (x-4)^2 + 6$$

$y = (x-4)^2 + 6$

First, subtract 6 from both sides of the equation:

$y - 6 = (x-4)^2$

Now, take the square root of both sides. Note that there are two possible solutions (positive and negative) for the square root:

$\pm\sqrt{y-6} = x - 4$

Add 4 to both sides to isolate x :

$x = 4 \pm \sqrt{y-6}$

So, x can be expressed as:

$x = 4 + \sqrt{y-6} \quad \text{or} \quad x = 4 - \sqrt{y-6}$

Therefore, x has two possible expressions in terms of y.