Question 1:

a)
$-\frac{3}{7}$ is a rational number.

$\sqrt{2}$ is an irrational number.

-6 is an integer.

b)
i.
$$10 - (2 \times +3 \times 2^2 + 1) = -9$$

i. (B)

ii.
$$10 - 3 \times 2 + 3 \times (2^2 + 1) = 19$$

ii. (C)

iii.
$$10 - 3 \times (2 + 3 \times 2^2) + 1 = -31$$

iii. (A)

c)
Given; 0.0476

i.
$$0.05$$

(to 2 d.p)

ii.
$$0.048$$

(to 2 s.f)

d)
When:

$$a = -3 \qquad b = -5$$

$$\frac{1-a^2}{b} = \frac{8}{5}$$

$$\frac{1-(-3)^2}{-5} = \frac{8}{5}$$

$$\frac{1-9}{-5} = \frac{8}{5}$$

$$\frac{8}{5} = \frac{8}{5}$$

GMC alert! You must evaluate the LHS only and 'show that' you arrive at the value given on the right hand side.

As required

e)

$$\begin{array}{lllll} 558 & = & 2^2 & 3 & 7^2 \\ 616 & = & 2^3 & 7 & 11 \end{array}$$

The HCF is $2^2 \times 7 = 28$

As required

Q1 6/6
A very good start!

(d) Substituting $a = -3$ and $b = -5$ into $\dfrac{1-a^2}{b}$

$$\begin{aligned} \frac{1-a^2}{b} &= \frac{1-(-3)^2}{-5} \\ &= \frac{1-9}{-5} \\ &= \frac{-8}{-5} \\ &= \frac{8}{5}. \end{aligned}$$

Hence,

$$\frac{1-a^2}{b} = \frac{8}{5}$$

when $a = -3$ and $b = -5$.

References

Activity 6 on page 17 of Book A (Unit 1) is similar.

Question 2:

a)
Simplify the given expressions.

i.
Given expression:

$$v \times vw^2 \times v^2w^3$$

First, multiply the first two terms:

$$v^2w^2 \times v^2w^3$$

Then, multiply the result with the remaining terms:

$$v^2w^2 \times v^2w^3$$

Final answer: ✓

$$v^4w^5$$

ii.
Given expression:

$$-2xy + (-3x \times 2y^2) - (-xy)$$

Distribute the brackets

You have lost the negative sign from the 2xy, when corrected the final answer contains -xy

$$2xy - 6xy^2 + xy$$

Collect like terms;

$$xy - 6xy^2$$

Factorise for the final answer;

$$xy(1 - 6y)$$ ✗

1/2

b)

Expand and simplify these expressions;

i.

Given expression;

$$7(e - f) - 2(e + f)$$

Distribute the brackets;

$$7e - 7f - 2e - 2f$$

Collect like terms:

$$7e - 2e - 7f - 2f$$

Final answer:

$$5e - 9f$$

ii.

Given expression

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

Distribute first 2 sets of brackets

$$x^2 - 4 + x(x - 3)$$

Distribute final set of brackets:

$$x^2 - 4 + x^2 - 3x$$

Collect like terms;

$$x^2 + x^2 - 3x - 4$$

Final answer:

$$2x^2 - 3x - 4$$

iii.

Given expression

2/3

$$(2m+3n)^2 = (2m+3n)(2m+3n)$$

Multiply out the brackets

$$4m^2 + 6mn + 6mn + 3n^2$$

Collect like terms, final answer;

$$3m^2 + 3n^2 + 12nm$$

3n x 3n = 9n^2

Q2 3/5

Question 3:

a)
Factorise the following expressions;

i.
Given expression:

$$3pq - 21pr$$

Factor out the HCF, 3:

$$3(pq - 7pr)$$

Factor out the common factor, p:

$$3p(q - 7r)$$

ii.

Given expression:

$$\frac{2}{5}y^2z + \frac{1}{2}y^3z^4$$

Multiply by the LMC, 10:

$$\frac{20}{5}y^2z + \frac{10}{2}y^3z^4$$

Distribute the terms;

$$4y^2z + 5y^3z^4$$

Factor out the common factor, y^2:

$$y^2(4z + 5yz^4)$$

Factor out the common factor, z, final answer:

$$y^2z(4 + 5yz^3)$$

As this is not an equation multiplying by 10 is not acceptable

(ii)

$$\frac{2}{5}y^2z + \frac{1}{2}y^3z^4 = \frac{1}{10}y^2z\left(4 + 5yz^3\right)$$

References

Activity 23 on page 45 of Book A (Unit 1) is similar.

1.5/2

b)

Simply the following algebraic fractions

i.

Given fraction:

$$\frac{24s^5t}{18s^2t^3}$$

Divide by 6:

$$\frac{4s^5t}{3s^2t^3}$$

Divide by s^2:

$$\frac{4s^3t}{3t^3}$$

Divide by t, final answer:

$$\frac{4s^3}{3t^2}$$

Where $s, t \neq 0$.

ii.

Given fraction:

$$\frac{2v^3 + v^2}{8v + 4}$$

Factor out 4 from $8v + 4$:

$$\frac{2v^3 + v^2}{4(2v + 1)}$$

2/2

Factor out v^2 from $2v^3 + v^2$:

$$\frac{v^2(2v + 1)}{4(2v + 1)}$$

✓

Final answer:

$$\frac{v^2}{4}$$

Where $v \neq \frac{-1}{2}$.

c)

Write the following as a single fraction:

$$\frac{2}{c} - \frac{3}{cd} + \frac{1}{d}$$

Write all fractions with the common denominator cd:

$$\frac{2d}{cd} - \frac{3}{cd} + \frac{c}{cd}$$

1/1

Final answer:

$$\frac{c + 2d - 3}{cd}$$

✓

Where $c, d \neq 0$.

d)
Simplify the following expression:

$$\left(\frac{2b}{a}\right) \Big/ \left(\frac{b^3 - 2ab^2}{4a^3 - 2a^2b}\right)$$

Multiply by the reciprocal:

$$\frac{2b}{a} \times \frac{4a^3 - 2a^2b}{b^3 - 2ab^2}$$

3/3

$$\frac{8a^3b - 4a^2b^2}{ab^3 - 2a^2b^2}$$

Factor out $-4a^2$ from $4a^3 - 2a^2b$;

$$\frac{-4a^2(b^2 - 2ab)}{ab^3 - 2a^2b^2}$$

Factor out ab from $ab^3 - 2a^2b^2$

$$\frac{-4a^2(b^2 - 2ab)}{ab(b^2 - 2ab)}$$

Cancel terms:

$$\frac{-4a^2}{ab}$$

Final answer;

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

Where $a, b \neq 0$ and $2a \neq b$.

Q3 8/8

Question 4:

a)
Show that:

$$
\begin{aligned}
\sqrt{7}(\sqrt{5}+\sqrt{3})-\sqrt{80} &= \sqrt{35}+\sqrt{21}-4\sqrt{4} \\
&= \sqrt{7}\times\sqrt{5}+\sqrt{7}\times\sqrt{3}-\sqrt{80} \\
&= \sqrt{7\times 5}+\sqrt{7\times 3}-\sqrt{80} \\
&= \sqrt{35}+\sqrt{21}-\sqrt{16\times 5} \\
&= \sqrt{35}+\sqrt{21}-\sqrt{16}\times\sqrt{5} \\
&= \sqrt{35}+\sqrt{21}-4\sqrt{5}
\end{aligned}
$$

1/1

As required

b)
Rationalise the denominator;

$$\frac{\sqrt{200}}{\sqrt{8}+\sqrt{3}}$$

Multiply by the conjugate radical;

$$\frac{\sqrt{200}}{\sqrt{8}+\sqrt{3}}\times\frac{\sqrt{8}-\sqrt{3}}{\sqrt{8}-\sqrt{3}}$$

$$\frac{\sqrt{200}\times\sqrt{8}-\sqrt{200}\times\sqrt{3}}{(\sqrt{8}-\sqrt{3})(\sqrt{8}-\sqrt{3})}$$

3/3

Simply:

$$\frac{\sqrt{1600}-\sqrt{600}}{\sqrt{8}\sqrt{8}-\sqrt{8}\sqrt{3}+\sqrt{3}\sqrt{8}-\sqrt{3}\sqrt{3}}$$

$$\frac{40-\sqrt{100}\times\sqrt{6}}{8-3}$$

$$\frac{40-10\sqrt{6}}{5}$$

Final answer:

$$8-2\sqrt{6}$$

c)

Using the index law, $(ab)^n = a^n b^n$

$$\frac{(3b^2c^{-1})^3}{bc^2} = \frac{3^3(b^2)^3(c^{-1})^3}{bc^2}$$

Then, using the index law, $(a^m)^n = a^{mn}$

$$= \frac{3^3b^6c^{-3}}{bc^2}$$

Next, using the index law $a^{-n} = \frac{1}{a^n}$

$$= \frac{3^3b^6b^{-1}}{c^3c^2}$$

0/1

Finally, using the index law $a^m a^n = a^{m+n}$

$$= \frac{27b^5}{c^5}$$

d)

Simplify the following expression

Given expression:

you have introduced a negative on this power

$$\frac{\sqrt[4]{(256x^3)}x^{\frac{-1}{2}}}{(64x^4)^{\frac{1}{5}}}$$

Rewrite the roots in Index Form:

$$\frac{(256x^3)^{\frac{1}{4}}x^{\frac{-1}{2}}}{64^{\frac{1}{5}}(x^4)^{\frac{1}{5}}}$$

Distribute the exponents:

$$\frac{256^{\frac{1}{4}}(x^3)^{\frac{1}{4}}x^{\frac{-1}{2}}}{64^{\frac{1}{5}}(x^4)^{\frac{1}{5}}}$$

Simplify each power:

$$\frac{256^{\frac{1}{4}}x^{\frac{3}{4}}x^{\frac{-1}{2}}}{64^{\frac{1}{5}}x^{\frac{4}{5}}}$$

Combine like terms in the numerator:

$$\frac{256^{\frac{1}{4}}x^{\frac{1}{4}}}{64^{\frac{1}{5}}x^{\frac{4}{5}}}$$

Simplify the fraction of exponents on x:

$$\frac{256^{\frac{1}{4}}x^{\frac{-11}{20}}}{64^{\frac{1}{5}}}$$

Rewrite the denominator as a radical:

2/3 The above error has resulted in the final answer being incorrect.
Please see the correct solution below.

$$\frac{256^{\frac{1}{4}}x^{\frac{-11}{20}}}{\sqrt[5]{64}}$$

Evaluate the radicals for 256 and 64:

$$\frac{4x^{\frac{-11}{20}}}{\sqrt[5]{32}\sqrt[5]{2}}$$

Further simplify the denominator:

$$\frac{4x^{\frac{-11}{20}}}{2\sqrt[5]{2}}$$

Combine exponents on 2:

$$\frac{2x^{\frac{-11}{20}}}{2^{\frac{1}{5}}}$$

Final answer:

$$\frac{2^{\frac{4}{5}}}{x^{\frac{11}{20}}}$$

(d) Since $x > 0$,

$$\begin{aligned}\frac{\sqrt[4]{(256x^3)}\,x^{1/2}}{(64x^4)^{1/5}} &= \frac{256^{1/4}\,x^{3/4}\,x^{1/2}}{64^{1/5}\,x^{4/5}}\\ &= \frac{4\,x^{3/4}\,x^{1/2}}{4^{3/5}\,x^{4/5}}\\ &= 4^{(1-3/5)}\,x^{(3/4+1/2-4/5)}\\ &= 4^{2/5}\,x^{9/20}\end{aligned}$$

Or

$$= 2^{4/5}\,x^{9/20}.$$

References

Example 21 on page 71 and Activity 40 on page 72 of Book A (Unit 1) are similar.

Q4 6/8

Question 5:

1/1

Similar to Q1d), it is a 'show that' question. You must show the substitution ahead of stating the answer which is given in the question.

(a) If $x = 3$ and $y = 4$, then,

$$\begin{aligned}\text{LHS} &= 7x + 6y \\ &= 7 \times 3 + 6 \times 4 \\ &= 21 + 24 \\ &= 45 \\ &= \text{RHS}\end{aligned}$$

So the equation is satisfied.

References
Activity 43 on page 75 of Book A (Unit 1) is similar.

a)

$$7x + 6y = 45$$

Substitute:

$$7(3) + 6(4) = 45$$

Evaluate:

$$21 + 24 = 45 \qquad \textit{as required}$$

b)
Solve:

2/2

Given equation:

$$2(x-3) = 4 - \frac{x}{2}$$

Multiply out the brackets:

$$2x - 6 = 4 - \frac{x}{2}$$

Multiply by 2:

$$4x - 12 = 8 - x$$

Collect like terms:

$$4x - x = 8 + 12$$

Evaluate:

$$5x = 20$$

Final answer:

$$x = 4$$

c)
Solve:

$$\frac{4}{x+2} + \frac{5}{2-3x} = 0$$

Given equation:

$$\frac{4}{x+2} + \frac{5}{2-3x} = 0$$

Cross multiply:

$$4(2-3x) + 5(x+2) = 0$$

Distribute the brackets:

$$8 - 12x + 5x + 10 = 0$$

Collect like terms:

$$10 + 8 = 12x - 5$$

3/3

Evaluate:

$$18 = 7x$$

Final answer:

$$x = \frac{18}{7}$$

$$\left(x \neq -2 \text{ and } x \neq \frac{2}{3}\right)$$

d)
Make y the subject

Given equation

$$xy + z = \frac{1}{z} - yz$$

$$xy + z = \frac{1}{z} - yz$$

3/3

Multiply by z:

$$xyz + z^2 = 1 - yz^2$$

Collect like terms:

$$xyz + yz^2 = 1 - z^2$$

Factor out y:

$$y(xz + z^2) = 1 - z^2$$

Divide by $(xz + z^2)$:

$$y = \frac{1 - z^2}{xz + z^2}$$

Final answer:

$$y = \frac{1 - z^2}{z(x + z)}$$

Q5 9/9

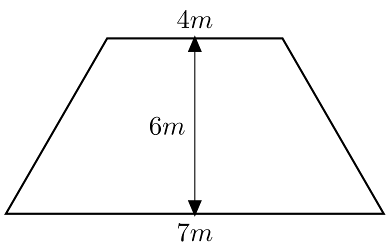
Question 6:

a)

- The given solution makes no reference to which calculation belongs to which design.
- The calculations do not indicate why each equation is used.
- The solutions do not contain units.
- The question asks for the answer to be given to the nearest penny, and neither answer does.
- The use of $*$ instead of $\times$ is inappropriate.

2/2

b)
Design one The first design option is a trapezium-shaped turf lawn, with parallel sides of $4\,\mathrm{m}$ and $7\,\mathrm{m}$ and a perpendicular height of $6\,\mathrm{m}$.



The area of a trapezium is given by the formula;

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

Area of the lawn:

$$\frac{1}{2}(a+b)h = area$$

Substitute dimensions:

$$\frac{1}{2}(4+7)6 = area$$

Total area

$$area = \frac{1}{2}(11)6$$

$$area = \frac{1}{2}(66)$$

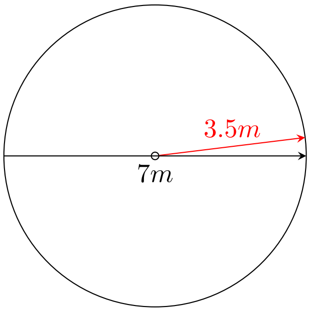
$$area = 33\,\mathrm{m}^2$$

The cost of turf is £5m^{-2}.

Therefore the total cost of the design would be

$$33\,\mathrm{m}^2 \times £5\mathrm{m}^{-2} = £165.00$$

Design 2 The second design is a circular lawn with a diameter of 7 m, so a radius of 3.5 m.



The area of a circle is given by the formula;

$$\pi r^2$$

Area of the lawn:

$$\pi r^2 = area$$

Substitute dimensions:

$$\pi \times 3.5^2 = area$$

3/3

Total area

$$area = \pi \times 12.25$$

$$area = 12.25\pi$$

$$area = 38.484\,\mathrm{m}^2 \ldots$$

The area of turf needed would be $\frac{49}{4}\pi\mathrm{m}^2$, approx $38.5\,\mathrm{m}^2$. As we can only buy turf by the m^2 we would need to buy $39\,\mathrm{m}^2$

The cost of turf is £5m^{-2}.

Therefore the total cost of the design would be

$$39\,\mathrm{m}^2 \times £5\mathrm{m}^{-2} = £195.00$$

Q6 5/5

Question 7:

PDF from Maxima included.

1 Question 7

1.1 a)

(% i15) fraca: 1695/2599;

(calc) $\frac{15}{23}$

(% i16) float(fraca);

(% o16) 0.6521739130434783

1.2 b)

(% i20) expb: 2*%pi-(%pi/3)+sqrt(2)+sqrt(8);

(expb) $\frac{5\pi}{3}+3\sqrt{2}$

1.3 c)

(% i22) expc: 2*x^ 3 + 9*x^ 2 +7*x -6;

(expc) $2x^3+9x^2+7x-6$

(% i24) factor(expc);

(% o24) $(x+2)\ (x+3)\ (2x-1)$

1.4 d)

(% i25) eqnd: 3*x^ 3 +5*x^ 2-26*x +8=0;

(eqnd) $3x^3+5x^2-26x+8=0$

(% i26) solve(eqnd, x);

(% o26) $\left[x=-4\,, x=\frac{1}{3}\,, x=2\right]$

1.5 e)

(% i27) eqne: q=(2*r*s +1)/(s+t);

(eqne) $q=\frac{2rs+1}{t+s}$

(% i29) solve(eqne, s);

(% o29) $\left[s=\frac{qt-1}{2r-q}\right]$

Q7 5/5

Question 8: **a)**

2/2 I am awarding both marks here, however please be mindful of 'show that' questions

b)

i.

Task	score
Working with Bidmas	5
Rounding numbers	5
Algebraic substitution	4
Rearranging fractions	4
Multiplying out brackets	4
Factorising expressions	4
Simplifying algebraic expressions	5
Solving equations	5
Rearranging equations	5

✓

ii.

Task	Score
Working with coordinates	5
Sketching straight line graphs	5
Understanding gradients and intercepts	5
Parallel and perpendicular lines	5
Solving simultaneous equations	4
Factorising quadratics	4
Solving quadratics using different methods	4
Sketching quadratic equations	4
Solving real life problems involving quadratic equations	4

✓

Q8 4/4
Thank you for sharing your self-reflection.
Do consider using practice quizzes on the module website for topics which you are not as confident in.