Functions and Trigonometry Summer Work

2019

Instructions

This work consists of Algebra II concepts that you are expected to have mastered upon entering Functions and Trig.

All problems in this packet should be completed on lined notebook paper. Work should be shown for all problems. Your work will be collected during the first week of school in the fall, and you will be tested over this material.

At the beginning of each section you will find example problems and links to videos that you may find helpful.

Answers to all problems can be found at the end of this packet.

Section A – Evaluating Exponential Expressions

Exponential expressions are of the form a^n. The integer n is the exponent and a is the base.

Example 1 $4^3 = 4 \times 4 \times 4 = 64$

Example 2 $(-6)^2 = (-6)(-6) = 36$

Example 3 $-6^2 = -(6 \times 6) = -36$

Example 4 $4 \times 3^2 = 4 \times 3 \times 3 = 36$

Example 5 $(4 \times 3)^2 = 12^2 = 12 \times 12 = 144$

Video Link: https://www.youtube.com/watch?v=vBVK2fkciaE

Section A – Exercises

A1) -2^4 A2) -3^5 A3) $(-2)^4$ A4) -2^6

A5) $(-3)^5$ A6) $(-2)^5$ A7) $-2(3)^4$ A8) $-4(-5)^3$

Section B – Order of Operations

Step 1 – Work separately above and below a fraction bar
Step 2 – If there are parenthesis or square brackets start with the innermost set and work outward
Step 3 – Simplify all powers and roots working from left to right
Step 4 – Do any multiplication or division working from left to right
Step 5 – Do any addition or subtractions working from left to right

Example 1 $6 \div 3 + 2^3 (5) =$

$2 + 8 (5) =$

$2 + 40 = 42$

Example 2 $(8 + 6) \div 7(3) -6 =$

$14 \div 7(3) -6 =$

$2(3) - 6 =$

$6 - 6 = 0$

Example 3 $\frac{4+3^2}{6-5(3)} =$

$\frac{4+9}{6-15} = -\frac{13}{9}$

Example 4 $\frac{-(-3)^3+(-5)}{2(-8)-5(3)} =$

$\frac{-(-27)+(-5)}{-16-15} =$

$\frac{27+(-5)}{-31} = \frac{22}{-31}$

Video Link: https://www.youtube.com/watch?v=zEnk8B7RkU4

Section B – Exercises

B1) -2 x 5 + 12 ÷ 3

B2) -4(9 – 8) + (-7)(2)^3

B3) $(4-2^3)(-2+\sqrt{25})$

B4) $\left(-\frac{2}{9}-\frac{1}{4}\right)-\left[-\frac{5}{18}-\left(-\frac{1}{2}\right)\right]$

B5) $\frac{-8+(-4)(-6)\div 12}{4-(-3)}$

Section C – Simplifying Expressions

Follow order of operations. Combine like terms. Simplify fractions.

Example 1 3(x + y) = 3x + 3y

Example 2 -(m – 4n) = -m + 4n

Example 3 $\frac{1}{3}\left(\frac{4}{5}m-\frac{3}{2}n-27\right)=\frac{4}{15}m-\frac{1}{2}n-9$

Video Link: https://www.youtube.com/watch?v=8Tyh2jzCpCE

Section C – Exercises

C1) $\frac{10}{11}(22z)$

C2) $\left(\frac{3}{4}r\right)(-12)$

C3) (m + 5) + 6

C4) 8 + (a + 7)

C5) $\frac{3}{8}\left(\frac{16}{9}y+\frac{32}{27}z-\frac{40}{9}\right)$

C6) $-\frac{1}{2}(20m+8y-32z)$

Section D – Evaluating Absolute Value Expressions

Absolute value can be thought of as distance. The absolute value of a number is that numbers distance from 0. Absolute value is always positive, because distance is always positive. With regard to order of operations, absolute value is a grouping symbol, just like parenthesis.

Example 1 $\left|-\frac{5}{8}\right| = \frac{5}{8}$

Example 2 $-|8| = -8$

Example 3 $-|-2| = -2$

Video Link: https://www.youtube.com/watch?v=F3aQCTtb4C4

Section D – Exercises

D1) $|-10|$ D2) $|-15|$ D3) $-\left|\frac{4}{7}\right|$ D4) $-\left|\frac{7}{2}\right|$

Let x = -4 and y = 2.

D5) $|x-y|$ D6) $|2x+5y|$ D7) $\frac{2|y|-3|x|}{|xy|}$ D8) $\frac{|-8y+x|}{-|x|}$

Section E – Product Rule for Exponents

When multiplying powers of like bases, keep the base and add the exponents.

$(a^m)(a^n) = a^{m+n}$

Example 1 $(y^4)(y^7) = y^{4+7} = y^{11}$

Example 2 $(6z^5)(9z^3)(2z^2) = (6)(9)(2)(z^{5+3+2}) = 108z^{10}$

Video Link: https://www.youtube.com/watch?v=bDpl2u4TPGU

Section E – Exercises

E1) $(9^3)(9^5)$ E2) $(4^2)(4^8)$ E3) $(-4x^2)(4x^2)$ E4) $(3y^4)(-6y^3)$ E5) $(n^6)(n^4)(n)$

E6) $(a^8)(a^5)(a)$ E7) $(-3m^4)(6m^2)(-4m^5)$ E8) $(-8t^3)(2t^6)(-5t^4)$

Section F – Power Rule for Exponents

To raise a power to a power, multiply exponents. Reminder – anything to the zero power is 1.

$(a^m)^n = a^{mn}$

Example 1 $(5^3)^2 = 5^6$

Example 2 $(3^4x^2)^3 = 3^{4(3)}x^{2(3)} = 3^{12}x^6$

Example 3 $\left(\frac{2^5}{b^4}\right)^3 = \frac{2^{5^3}}{b^{4^3}} = \frac{2^{15}}{b^{12}}$

Example 4 $\left(\frac{-2m^6}{t^2z}\right)^5 = \frac{(-2)^5(m^6)^5}{(t^2)^5z^5} = \frac{-32m^{30}}{t^{10}z^5}$

Video Link: https://www.youtube.com/watch?v=7MZsfSqkV44

Section F – Exercises

F1) $(2^2)^5$ F2) $(6^4)^3$ F3) $(-6x^2)^3$ F4) $(-2x^5)^5$ F5) $-(4m^3n^0)^2$

F6) $(2x^0y^4)^3$ F7) $\left(\frac{r^8}{s^2}\right)^3$ F8) $-\left(\frac{p^4}{q}\right)^2$ F9) $\left(\frac{-4m^2}{t}\right)^4$ F10) $\left(\frac{-5n^4}{r^2}\right)^3$

Section G – Adding and Subtracting Polynomials

Polynomials are added by adding (combining) like terms. When polynomials are subtracted, it is usually best to distribute the subtraction (distribute a negative 1) and then add.

Example 1 $(2y^4 – 3y^2 + y) + (4y^4 + 7y^2 + 6y) =$

$2y^4 + 4y^4 + -3y^2 + 7y^2 + y + 6y =$

$6y^4 + 4y^2 + 7y$

Example 2 $(-3m^3 – 8m^2 + 4) – (m^3 + 7m^2 – 3) =$

$-3m^3 + -m^3 + -8m^2 + -7m^2 + 4 + 3 =$

$-4m^3 – 15m^2 + 7$

Example 3 $4(x^2 - 3x + 7) - 5(2x^2 - 8x - 4) =$

$4x^2 + -12x + 28 + -10x^2 + 40x + 20 =$

$-6x^2 + 28x + 48$

Video Link: https://www.youtube.com/watch?v=IDpnNnjFB1c

Section G - Exercises

G1) $(5x^2 - 4x + 7) + (-4x^2 + 3x - 5)$

G2) $(3m^3 - 3m^2 + 4) + (-2m^3 - m^2 + 6)$

G3) $2(12y^2 - 8y + 6) - 4(3y^2 - 4y + 2)$

G4) $3(8p^2 - 5p) - 5(3p^2 - 2p + 4)$

Section H – Multiplying Polynomials

Every term in the first expression needs to be multiplied by every term in the second expression. (FOIL)

Example 1 $(6m + 1)(4m - 3) =$

$23m^2 - 18m + 4m - 3 =$

$23m^2 - 14m - 3$

Example 2 $(2x + 7)(2x - 7) =$

$4x^2 - 14x + 14x - 49 =$

$4x^2 - 49$

Example 3 $r^2(3r + 2)(3r - 2) =$

$r^2(9r^2 - 6r + 6r - 4) =$

$r^2(9r^2 - 4) =$

$9r^4 - 4r^2$

Example 4 $(3p^2 - 4p + 1)(p^3 + 2p - 8) =$

$3p^5 + 6p^3 - 24p^2 - 4p^4 - 8p^2 + 32p + p^3 + 2p - 8 =$

$3p^5 - 4p^4 + 7p^3 - 32p^2 + 34p - 8$

Video Link: https://www.youtube.com/watch?annotation_id=annotation_2909028083&feature=iv&src_vid=wUYa2NAV5t4&v=J18DrAkvaYg

Section H - Exercises

H1) $(4r - 1)(7r + 2)$ H2) $x^2\left(3x - \frac{2}{3}\right)\left(5x + \frac{1}{3}\right)$ H3) $4x^2(3x^3 + 2x^2 - 5x + 1)$

H4) $(2z - 1)(-z^2 + 3z - 4)$ H5) $(m - n + k)(m + 2n - 3k)$

Section I – Factoring out the greatest common factor

First find the greatest common factor and divide every term by it.

Example 1 $9y^5 + y^2$ The greatest common factor is y^2

$y^2(9y^3 + 1)$

Example 2 $6x^2t + 8xt + 12t$ The greatest common factor is $2t$

$2t(3x^2 + 4x + 6)$

Video Link: https://www.youtube.com/watch?v=3RJlPvX-3vg

Section I Exercises

I1) $12m + 60$ I2) $8k^3 + 24k$ I3) $xy - 5xy^2$ I4) $-4p^3q^4 - 2p^2q^5$ I5) $4k^2m^3 + 8k^4m^3 - 12k^2m^4$

I6) $28r^4s^2 + 7r^3s - 35r^4s^3$

Section J – Factoring Trinomials

There are many methods for factoring trinomials. You may have been taught the box method, the AC method, guess and check, or something else. No matter what method you use, what you are doing is un-FOILing.

Example 1 $4y^2 - 11y + 6 = (y - 2)(4y - 3)$

Example 2 $6p^2 - 7p - 5 = (3p - 5)(2p + 1)$

Example 3 $2x^2 + 13x - 18$ = cannot be factored

Example 4 $16y^3 + 24y^2 - 16y$ (pull out the greatest common factor first)

$8y(2y^2 + 3y - 2)$ (now factor the trinomial)

$8y(2y - 1)(y + 2)$

Video Link: Box Method https://www.youtube.com/watch?v=_Wb_CT-1VN8

Another Method https://www.youtube.com/watch?v=gqohYwpih8U

AC Method https://www.youtube.com/watch?v=NFZRoDDy2n8

Section J Exercises

J1) $6a^2 - 11a + 4$ J2) $3m^2 + 14m + 8$ J3) $15p^2 + 24p + 8$ J4) $12a^3 + 10a^2 - 42a$

J5) $6k^2 + 5kp - 6p^2$ J6) $5a^2 - 7ab - 6b^2$ J7) $12x^2 - xy - y^2$ J8) $9m^2 - 12m + 4$

Section K – Simplifying Rational Expressions

You should always factor first, then factors can be cancelled. You can NEVER cancel terms.

Example 1 $\frac{2p^2+7p-4}{5p^2+20p} = \frac{(2p-1)(p+4)}{5p(p+4)} = \frac{2p-1}{5p}$

Example 2 $\frac{6-3k}{k^2-4} = \frac{3(2-k)}{(k+2)(k-2)} = \frac{3(-1)(k-2)}{(k+2)(k-2)} = \frac{-3}{k+2}$

Video Link: https://www.youtube.com/watch?v=MeS4FTGTb-c

Section K Exercises

K1) $\frac{8k+16}{9k+18}$ K2) $\frac{3(3-t)}{(t+5)(t-3)}$ K3) $\frac{8x^2+16x}{4x^2}$ K4) $\frac{m^2-4m+4}{m^2+m-6}$ K5) $\frac{8m^2+6m-9}{16m^2-9}$

Section L – Multiplying and Dividing Rational Expressions

Again, ALWAYS factor first if possible.

If you can cancel anything, it will make the problem easier if you cancel factors first.

When multiplying, multiply straight across. In other words, multiply the numerators and then multiply the denominators.

When dividing, you will multiply by the reciprocal of the second fraction.

Example 1 $\frac{2y^2}{9}\cdot\frac{27}{8y^5}=\frac{2y^2}{9}\cdot\frac{9\cdot 3}{2y^2\cdot 4y^3}=\frac{3}{4y^3}$

Example 2 $\frac{3m^2-2m-8}{3m^2+14m+8}\cdot\frac{3m+2}{3m+4}=\frac{(m-2)(3m+4)}{(m+4)(3m+2)}\cdot\frac{3m+2}{3m+4}=\frac{m-2}{m+4}$

Example 3 $\frac{3p^2+11p-4}{24p^3-8p^2}\div\frac{9p+36}{24p^4-36p^3}=\frac{(p+4)(3p-1)}{8p^2(3p-1)}\div\frac{9(p+4)}{12p^3(2p-3)}=\frac{(p+4)(3p-1)}{8p^2(3p-1)}\div\frac{9(p+4)}{12p^3(2p-3)}=$

$\frac{p+4}{8p^2}\cdot\frac{4p^3(2p-3)}{3(p+4)}=\frac{p(2p-3)}{6}$

Video Link: https://www.youtube.com/watch?v=WbvLjmK4Kmc

Section L Exercises

L1) $\frac{15p^3}{9p^2}\div\frac{6p}{10p^2}$ L2) $\frac{2k+8}{6}\div\frac{3k+12}{2}$ L3) $\frac{x^2+x}{5}\cdot\frac{25}{xy+y}$ L4) $\frac{4a+12}{2a-10}\div\frac{a^2-9}{a^2-a-20}$

L5) $\frac{p^2-p-12}{p^2-2p-15}\cdot\frac{p^2-9p+20}{p^2-8p+16}$ L6) $\frac{m^2+3m+2}{m^2+5m+4}\div\frac{m^2+5m+6}{m^2+10m+24}$

Section M – Adding and Subtracting Rational Expressions

To add or subtract two fractions (rational expressions), find the least common denominator and change each fraction (multiply the top and the bottom) to one with the least common denominator. Add or subtract the numerators, keep the denominator.

Example 1 $\frac{5}{9x^2}+\frac{1}{6x}=\frac{5(2)}{9x^2(2)}+\frac{1(3x)}{6x(3x)}=\frac{10}{18x^2}+\frac{3x}{18x^2}=\frac{10+3x}{18x^2}$

Example 2 $\frac{y}{y-2}+\frac{8}{2-y}=\frac{y}{y-2}+\frac{8(-1)}{(2-y)(-1)}=\frac{y}{y-2}+\frac{-8}{y-2}=\frac{y-8}{y-2}$

Example 3 $\frac{3}{(x-1)(x+2)}-\frac{1}{(x+3)(x-4)}=\frac{3(x+3)(x-4)}{(x-1)(x+2)(x+3)(x+4)}-\frac{1(x-1)(x+2)}{(x+3)(x-4)(x-1)(x+2)}=$

$\frac{3(x^2-x-12)}{(x-1)(x+2)(x+3)(x+4)}+\frac{-1(x^2+x-2)}{(x-1)(x+2)(x+3)(x+4)}=\frac{3x^2-3x-36-x^2-x+2}{(x-1)(x+2)(x+3)(x+4)}=$

$\frac{2x^2-4x-34}{(x-1)(x+2)(x+3)(x+4)}$

Video Link: https://www.youtube.com/watch?v=d3xr5a4cln0

Section M Exercises

M1) $\frac{3}{2k}+\frac{5}{3k}$ M2) $\frac{1}{6m}+\frac{2}{5m}+\frac{4}{m}$ M3) $\frac{1}{a}-\frac{b}{a^2}$ M4) $\frac{5}{12x^2y}-\frac{11}{6xy}$ M5) $\frac{17y+3}{9y+7}-\frac{-10y-18}{9y+7}$

M6) $\frac{1}{x+z}+\frac{1}{x-z}$ M7) $\frac{3}{a-2}-\frac{1}{2-a}$ M8) $\frac{x+y}{2x-y}-\frac{2x}{y-2x}$ M9) $\frac{3x}{x^2+x-12}-\frac{x}{x^2-16}$

Section N – Negative Exponents and the Quotient Rule

If a number or variable has a negative exponent attached, the negative on the exponent means take the reciprocal. After you take the reciprocal, the negative is gone.

$$a^{-n}=\frac{1}{a^n}$$

When dividing powers of like bases, keep the base and subtract the exponents.

$$\frac{a^m}{a^n}=a^{m-n}$$

Remember that anything to the zero power is 1.

Example 1 $\frac{12^5}{12^3}=12^3$

Example 2 $\frac{a^5}{a^{-8}}=a^{5-(-8)}=a^{13}$

Example 3 $\frac{16m^{-9}}{12m^{11}} = \frac{4}{3m^{20}}$

Example 4 $\frac{25r^7z^5}{10r^9z} = \frac{5z^4}{2r^2}$

Example 5 $3x^{-2}(4^{-1}x^{-5})^2 = 3x^{-2}4^{-2}x^{-10} = 3x^{-12}4^{-2} = \frac{3}{16x^{12}}$

Video Link: https://www.youtube.com/watch?v=c4aiYf3fzVQ

Section N Exercises

N1) $(-4)^{-3}$ N2) -5^{-4} N3) $\left(\frac{1}{3}\right)^{-2}$ N4) $(4x)^{-2}$ N5) $4x^{-2}$ N6) $-a^{-3}$

N7) $\frac{4^8}{4^6}$ N8) $\frac{x^{12}}{x^8}$ N9) $\frac{r^7}{r^{10}}$ N10) $\frac{6^4}{6^{-2}}$ N11) $\frac{4r^{-3}}{6r^{-6}}$ N12) $\frac{16m^{-5}n^4}{12m^2n^{-3}}$

N13) $-4r^{-2}(r^4)^2$ N14) $(5a^{-1})^4(a^2)^{-3}$ N15) $\frac{(p^{-2})^0}{5p^{-4}}$ N16) $\frac{(3pq)q^2}{6p^2q^4}$

N17) $\frac{4a^5(a^{-1})^3}{(a^{-2})^{-2}}$

Section O – Rational Exponents

$a^{1/n}$ is the same as the nth root of a.

Example 1 $36^{1/2} = \sqrt{36} = 6$

Example 2 $-100^{1/2} = -10$

Example 3 $-(225)^{1/2} = -15$

Example 4 $625^{1/4} = 5$

Example 5 $(-1296)^{1/4} = non\ real$

Example 6 $-1296^{1/4} = -6$

Example 7 $(-27)^{1/3} = -3$

Example 8 $-32^{1/5} = -2$

Video Link: https://www.youtube.com/watch?v=3YbwhlqlvPs

Section O Exercises

O1) $169^{1/2}$ O2) $121^{1/2}$ O3) $16^{1/4}$ O4) $625^{1/4}$ O5) $\left(-\frac{64}{27}\right)^{1/3}$ O6) $\left(\frac{8}{27}\right)^{1/3}$

O7) $(-4)^{1/2}$ O8) $(-64)^{1/4}$

Section P = More with rational exponents

If you have an expression like $a^{m/n}$, m is a power, n is a root. It is usually easier if you evaluate the root first and then apply the power.

Example 1 $125^{2/3} = 5^2 = 25$

Example 2 $32^{7/5} = 2^7 = 128$

Example 3 $-81^{3/2} = -9^3 = -729$

Example 4 $(-27)^{2/3} = (-3)^2 = 9$

Example 5 $(16)^{-3/4} = (2)^{-3} = \frac{1}{8}$

Video Link: https://www.youtube.com/watch?v=ry-oYLDi4L8

Section P Exercises

P1) $8^{2/3}$ P2) $100^{3/2}$ P3) $-81^{3/4}$ P4) $\left(\frac{27}{64}\right)^{-4/3}$ P5) $3^{1/2} \cdot 3^{3/2}$

P6) $\frac{64^{5/3}}{64^{4/3}}$ P7) $y^{7/3} \cdot y^{-4/3}$

Section Q – Simplifying Radicals

Example 1 $\sqrt{175} = \sqrt{25 \cdot 7} = 5\sqrt{7}$

Example 2 $-3\sqrt[5]{32} = -3 \cdot 2 = -6$

Example 3 $\sqrt[3]{81x^5y^7z^6} = \sqrt[3]{27 \cdot 3 \cdot x^3 \cdot x^2 \cdot y^6 \cdot y \cdot z^6} = 3xy^2z^2\sqrt[3]{3x^2y}$

Video Link: https://www.youtube.com/watch?v=pZSuMBXzEic

Section Q Exercises

Q1) $\sqrt[3]{16(-2)^4(2)^8}$ Q2) $\sqrt[3]{25(3)^4(5)^3}$ Q3) $\sqrt{8x^5z^8}$ Q4) $\sqrt{24m^6n^5}$ Q5) $\sqrt{\frac{x^5y^3}{z^2}}$

Q6) $\sqrt{\frac{g^3h^5}{r^3}}$ Q7) $\sqrt[3]{\frac{8}{x^2}}$ Q8) $\sqrt[4]{\frac{32x^5}{y^5}}$

Section R – Review

Perform the indicated operations.

R1) $(x^2 - 3x + 2) - (x - 4x^2) + 3x(2x + 1)$

R2) $(6r - 5)^2$

R3) $(t + 2)(3t^2 - t + 4)$

R4) $\frac{2x^3 - 11x^2 + 28}{x - 5}$

Factor completely.

R5) $6x^2 - 17x + 7$

R6) $x^4 - 16$

R7) $24m^3 - 14m^2 - 24m$

Perform the indicated operations.

R8) $\frac{5x^2 - 9x - 2}{30x^3 + 6x^2} \cdot \frac{2x^8 + 6x^7 + 4x^6}{x^4 - 3x^2 - 4}$

R9) $\frac{x}{x^2 + 3x + 2} + \frac{2x}{2x^2 - x - 3}$

R10) $\frac{a + b}{2a - 3} - \frac{a - b}{3 - 2a}$

Simplify so there are no negative exponents

R11) $\left(\frac{x^{-2} y^{-1/3}}{x^{-5/3} y^{-2/3}}\right)^3$

Evaluate

R12) $\left(-\frac{64}{27}\right)^{\frac{-2}{3}}$

Simplify

R13) $\sqrt{18x^5 y^8}$

R14) $\sqrt{32x} + \sqrt{2x} - \sqrt{18x}$

Answers

A1) -16   A2) -243   A3) 16   A4) -64

A5) -243   A6) -32   A7) -162   A8) 500

B1) -6   B2) -60   B3) -12   B4) $-\frac{25}{36}$ B5) $-\frac{6}{7}$

C1) 20z   C2) -9r   C3) m + 11   C4) 15 + a   C5) $\frac{2}{3}y + \frac{4}{9}z - \frac{5}{3}$

C6) -5m – 2y + 8z

D1) 10   D2) 15   D3) $-\frac{4}{7}$ D4) $-\frac{7}{2}$ D5) 6   D6) 2

D7) -1   D8) -5

E1) 9^8 E2) 4^{10} E3) $-16x^4$ E4) $-18y^7$ E5) n^{11} E6) a^{14}

E7) $72m^{11}$ E8) $80t^{13}$

F1) 2^{10} F2) 6^{12} F3) $-216x^6$ F4) $-32x^{25}$ F5) $-16m^6$ F6) $8y^4$

F7) $\frac{r^{24}}{s^6}$ F8) $-\frac{p^8}{q^2}$ F9) $\frac{256m^8}{t^4}$ F10) $\frac{-125n^{12}}{r^6}$

G1) $x^2 - x + 2$ G2) $m^3 - 4m^2 + 10$ G3) $12y^2 + 4$ G4) $9p^2 - 5p - 20$

H1) $28r^2 + r - 2$ H2) $15x^4 - \frac{7}{3}x^3 - \frac{2}{9}x^2$ H3) $12x^5 + 8x^4 - 20x^3 + 4x^2$

H4) $-2z^3 + 7z^2 - 11z + 4$ H5) $m^2 + mn - 2n^2 - 2km + 5kn - 3k^2$

I1) $12(m + 5)$ I2) $8k(K^2 + 3)$ I3) $xy(1 - 5y)$ I4) $-2p^2q^4(2p + q)$ I5) $4k^2m^3(1 + 2k^2 - 3m)$

I6) $-3z^3w^2(z^2 + 6w^2)$

J1) $(2a - 1)(3a - 4)$ J2) $(3m + 2)(m + 4)$ J3) prime J4) $2a(3a + 7)(2a - 3)$

J5) $(3k - 2p)(2k + 3p)$ J6) $(5a + 3b)(a - 2b)$ J7) $(4x + y)(3x - y)$ J8) $(3m - 2)^2$

K1) $\frac{8}{9}$ K2) $\frac{-3}{t+5}$ K3) $\frac{2x+4}{x}$ K4) $\frac{m-2}{m+3}$ K5) $\frac{2m+3}{4m+3}$

L1) $\frac{25p^2}{9}$ L2) $\frac{2}{9}$ L3) $\frac{5x}{y}$ L4) $\frac{2(a+4)}{a-3}$ L5) 1 L6) $\frac{m+6}{m+3}$

M1) $\frac{19}{6k}$ M2) $\frac{137}{30m}$ M3) $\frac{a-b}{a^2}$ M4) $\frac{5-22x}{12x^2y}$ M5) 3 M6) $\frac{2x}{(x+z)(x-z)}$

M7) $\frac{4}{a-2}$ M8) $\frac{3x+y}{2x-y}$ M9) $\frac{2x^2-9x}{(x-3)(x+4)(x-4)}$

N1) $-\frac{1}{64}$ N2) $-\frac{1}{625}$ N3) 9 N4) $\frac{1}{16x^2}$ N5) $\frac{4}{x^2}$ N6) $-\frac{1}{a^3}$

N7) 16 N8) x^4 N9) $\frac{1}{r^3}$ N10) 6^6 N11) $\frac{2r^3}{3}$ N12) $\frac{4n^7}{3m^7}$

N13) $-4r^6$ N14) $\frac{5^4}{a^{10}}$ N15) $\frac{p^4}{5}$ N16) $\frac{1}{2pq}$ N17) $\frac{4}{a^2}$

O1) 13 O2) 11 O3) 2 O4) 5 O5) $-\frac{4}{3}$ O6) $\frac{2}{3}$

O7) nonreal O8) nonreal

P1) 4 P2) 1000 P3) -27 P4) $\frac{256}{81}$ P5) 9 P6) 4 P7) y

Q1) $32\sqrt[3]{2}$ Q2) $15\sqrt[3]{75}$ Q3) $2x^2z^4\sqrt{2x}$ Q4) $2m^3n^2\sqrt{6n}$ Q5) $\frac{x^2y\sqrt{xy}}{z}$

Q6) $\frac{gh^2}{r}\sqrt{\frac{gh}{r}}$ Q7) $\frac{2\sqrt[3]{x}}{x}$ Q8) $\frac{2x}{y}\sqrt[4]{\frac{2x}{y}}$

R1) $11x^2 - x + 2$

R2) $36r^2 - 60r + 25$

R3) $3t^3 + 5t^2 + 2t + 8$

R4) $2x^2 - x - 5 + \frac{3}{x-5}$

R5) $(3x - 7)(2x - 1)$

R6) $(x^2 + 4)(x - 2)(x + 2)$

R7) $2m(4m + 3)(3m - 4)$

R8) $\frac{x^4(x+1)}{3(x^2+1)}$

R9) $\frac{x(4x+1)}{(x+2)(x+1)(2x-3)}$

R10) $\frac{2a}{2a-3}$

R11) $\frac{y}{x}$

R12) $\frac{9}{16}$

R13) $3x^2y^4\sqrt{2x}$

R14) $2\sqrt{2x}$