Exam Two Review

This is a (lengthy) practice exam for Exam 2 on Polynomials.

NOTE: There may be random lines that look like `\texttt{(SOME TEXT)}` and maybe even some `{ }` within that text. You can ignore everything that isn't the text itself; ie the texttt bit and the braces, they are an artifact of how some randomization is being done that I haven't had time to fix yet. If you literally delete the `\texttt` and the braces from what you see, and just keep the text itself, it will read exactly as intended. So just ignore all those texttt and braces whenever you see them.

Also note: Some of the below has randomized elements, some do not. Currently Xronos does not support randomized graphing (although we're working on it!) so a lot of the graphing problems won't randomize, but a surprising amount of the other problems will change values or text if you hit the green "another" button in the top right corner to get another version of this practice exam. This also means it may take some time for the entire test to render because we have to rely on public servers to do the randomization for us currently, so please be patient. If it takes more than 3-5 minutes to fill out the random values (meaning: if there are still spinning wheels of death going after 3-5 minutes) there is a problem. Try hitting the "another" button to see if it resolves itself. If it keeps doing this, please contact your instructor and let him know!

Problem 1 *Which of the following is a proper full factorization (using real coefficients) of the polynomial:*

$$p(x) = 2\,x^3 + 7\,x^2 - 18\,x - 63$$

Multiple Choice:

(a) $(2\,x - 7)(x^2 - 9)$

(b) $(2\,x + 7)(x - 3)(x + 3)$ ✓

(c) *This is not factorable with real coefficients.*

(d) $(2\,x + 7)(x - 9)(x + 9)$

(e) $(2\,x + 7)(x^2 - 9)$

Learning outcomes:

Problem 2 *What is the remainder when* $x^4 + 11\,x^3 + 41\,x^2 + 66\,x + 31$ *is divided by* $x^2 + 6\,x + 5$*?*

Multiple Choice:

(a) $-5\,x - 1$

(b) $x + 3$

(c) $5\,x + 1$ ✓

(d) *0*

(e) $x + 5$

Problem 3 *Given a polynomial with leading term* $-10\,x^7$ *what can be said about the absolute extrema it has?*

Multiple Choice:

(a) *There is not enough information to tell.*

(b) *It must have at least one absolute extrema; but we don't know if it is a max or min.*

(c) *It must have an absolute minimum.*

(d) *It must have an absolute maximum.*

(e) *It has no absolute extrema.* ✓

Problem 4 *Can the Rational Root theorem be used to find zeros of a polynomial that has (some) complex-valued zeros?*

Multiple Choice:

(a) *No, rational root theorem only works on polynomials with all real roots.*

(b) *Yes, but only if it has roots that are rational in addition to any complex-valued roots.* ✓

(c) *Yes, the rational root theorem works on all polynomials.*

(d) *No, rational root theorem only works on polynomials with all rational roots.*

(e) *None of the other responses are correct.*

Problem 5 *Which of the following is a proper factorization (using real coefficients) of the polynomial*

$$p(x) = 2\,x^2 - 21\,x + 49$$

Multiple Choice:

(a) $(2\,x + 7)(x + 7)$

(b) $(2\,x + 7)(x - 7)$

(c) $(2\,x - 7)(x + 7)$

(d) $(2\,x - 7)(x - 7)$ ✓

(e) *This is not factorable with real coefficients.*

Problem 6 *Consider the polynomial* $p(x) = 4\,x^3 + 12\,x^2 - x - 3$. *What is the sum of the zeros of* $p(x)$*?*

Multiple Choice:

(a) 1

(b) -3 ✓

(c) -2

(d) -4

(e) 3

Problem 7 *Complete the square on the expression*

$$2\,x^2 + 8\,x + 4$$

to get it into the form $A(x + B)^2 + C$. *Which of the following is correct:*

Multiple Choice:

(a) $A \in [1.7, 2.2]$, $B \in [1.7, 2.4]$, *and* $C \in [-4.5, -3.8]$

(b) $A \in [0.8, 1.2]$, $B \in [3.6, 4.3]$, *and* $C \in [-4.5, -3.8]$

(c) $A \in [0.8, 1.2]$, $B \in [1.7, 2.4]$, *and* $C \in [-0.2, 0.4]$

(d) $A \in [1.7, 2.2]$, $B \in [3.6, 4.3]$, *and* $C \in [-4.5, -3.8]$ ✓

(e) $A \in [1.7, 2.2]$, $B \in [3.6, 4.3]$, *and* $C \in [-0.2, 0.4]$

Problem 8 *Consider the polynomial* $p(x) = x^4 + 7\,x^3 - 28\,x^2 - 160\,x$. *Which of the following are true?*

I: $p(x)$ *is degree 4.*

II: $p(x)$ *has 4 real zeros.*

III: The sum of the zeros of $p(x)$ *is* -7.

IV: The product of the zeros of $p(x)$ *is 0.*

Multiple Choice:

(a) *Only I, II and IV are correct*

(b) *Only I is correct*

(c) *Only I, III, and IV are correct.*

(d) *Only I and IV are correct*

(e) *All of these are correct.* ✓

Problem 9 *What is the leading coefficient of* $(-11\,x^5) + (11\,x^8) + (-21\,x^4) + (8\,x^7) + (-14\,x^2)$*?*

Multiple Choice:

(a) -21

(b) 11 ✓

(c) -11

(d) 8

(e) -14

Problem 10 *What number would you add and subtract to the polynomial* $p(x) = x^2 + 6\,x - 2$ *in order to complete the square?*

Multiple Choice:

(a) 6

(b) *There is not enough information.*

(c) 36

(d) 3

(e) 9 ✓

Problem 11 *Simplify the following:* $\dfrac{2i+2}{4i-1}$.

Multiple Choice:

(a) $-\dfrac{10}{17}i + \dfrac{6}{17}$ ✓

(b) $-10i + 6$

(c) $\dfrac{6}{17}i - \dfrac{10}{17}$

(d) $\dfrac{6}{17}i + \dfrac{10}{17}$

(e) $-\dfrac{10}{17}i - \dfrac{6}{17}$

Problem 12 *Factor the polynomial* $p(x) = x^6 - 100$ *using real coefficients.*

Multiple Choice:

(a) $(x - \sqrt[3]{10})(x + \sqrt[3]{10})(x^2 + \sqrt[3]{10}x + \sqrt[3]{100})(x^2 - \sqrt[3]{10}x + \sqrt[3]{100})$ ✓

(b) $p(x)$ *cannot be factored further.*

(c) $(x^3 - 10)(x^3 + 10)$

(d) $(x - \sqrt[3]{10})(x + \sqrt[3]{10})(x^2 + \sqrt[3]{10}x + \sqrt[3]{100})(x - \sqrt[3]{100})^2(x - \sqrt[3]{100})^2$

(e) $(x - \sqrt[3]{100})^2(x - \sqrt[3]{100})^2(x^2 - 10)$

Problem 13 *Which of the following is a zero of the polynomial* $p(x) = 240\,x^4 - 386\,x^3 - 228\,x^2 + 74\,x + 12$*?*

Multiple Choice:

(a) 2 ✓

(b) -1

(c) 8

(d) 6

(e) 1

Problem 14 *Which of the following is a proper factorization of the polynomial* $p(x) = x^4 - 256$ *(using real coefficients):*

Multiple Choice:

(a) $\big(x^2 + 16\big)(x - 4)^2$

(b) $\big(x^2 + 16\big)\big(x^2 - 16\big)(x + 4)$

(c) $\big(x^2 + 16\big)\big(x^2 - 16\big)$

(d) $\big(x^2 + 16\big)(x + 4)(x - 4)$ ✓

(e) *This is not factorable with real coefficients.*

Problem 15 *Consider the monomial* $p(x) = -2\,x^7$*. Does* $p(x)$ *have any absolute extrema, if so which type?*

Multiple Choice:

(a) *No $p(x)$ has no absolute extrema.* ✓

(b) *Yes $p(x)$ has an absolute minimum.*

(c) *Yes, $p(x)$ has both an absolute maximum and minimum.*

(d) *No, $p(x)$ does not have any absolute extrema, but it does have relative extrema.*

(e) *Yes $p(x)$ has an absolute maximum.*

Problem 16 *When using the AC-method, we are really...*

Multiple Choice:

(a) *using an associated polynomial which allows us to use coefficient method on the original polynomial.*

(b) *using an associate polynomial to fact via the quadratic formula.*

(c) *using an associated polynomial to figure out how to split the middle term to factor by grouping.* ✓

(d) *using the original polynomial to factor an associate polynomial via the coefficient method.*

(e) *using the original polynomial and guessing at values to figure out how to group the terms.*

Problem 17 *Consider the polynomial $p(x) = 33\,x^3 - 11\,x^2 - 19\,x + 35$. Which of the following can **not** be a root of the polynomial?*

Multiple Choice:

(a) $3\,x - 35$

(b) $5\,x - 3$ ✓

(c) $11\,x - 5$

(d) $3\,x - 7$

(e) $11\,x - 7$

Problem 18 *Simplify the following:* $4i - 2 + 4i + 1$.

Multiple Choice:

(a) $-1 + (8) \cdot i$ ✓

(b) $-1 + (4) \cdot i + (4) \cdot i$

(c) $-2 + (8) \cdot i$

(d) $-2 + (16) \cdot i$

(e) $-1 + (16) \cdot i$

Problem 19 *When factoring using the coefficient method the original polynomial must...*

Multiple Choice:

(a) *be a quadratic form with leading coefficient of 1.* ✓

(b) *have at least three terms.*

(c) *have a non-zero constant term.*

(d) *have a non-zero coefficient for the degree one term.*

(e) *be a degree two polynomial (with any leading coefficient).*

Problem 20 *Which of the following is a proper factorization of the polynomial* $p(x) = x^2 - 4$ *(using real coefficients):*

Multiple Choice:

(a) *This is not factorable with real coefficients.*

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

(c) $(x - 2)(x + 2)$ ✓

(d) $(x - 4)(x - 4)$

(e) $(x-4)(x+2)$

Problem 21 *Which of the following is a proper factorization (using real coefficients) of the polynomial*

$$p(x) = 4\,x^4 - 45\,x^2 + 81$$

Multiple Choice:

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

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

(c) $(-x-3)^2(-2\,x-3)^2$

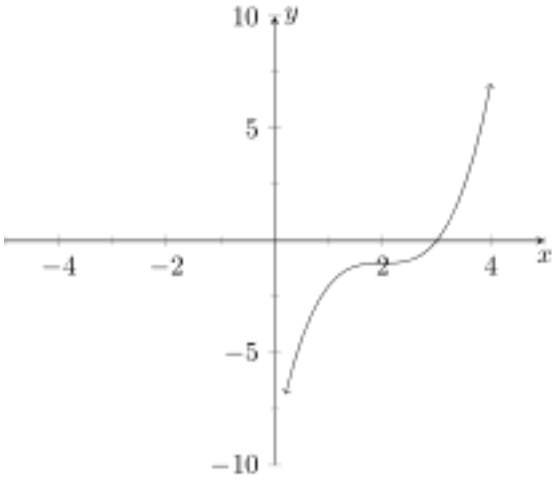
(d) *This is not factorable with real coefficients.*

(e) $(-x-3)(-x+3)(-2\,x-3)(-2\,x+3)$ ✓

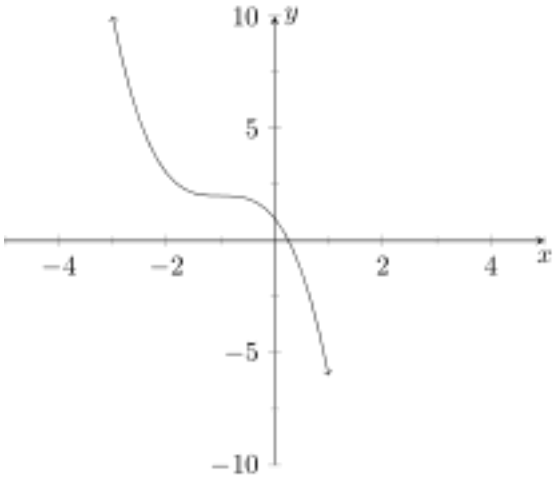
Problem 22 *Which of the following is the graph of* $f(x) = (-x+2)^3 - 1$*?*

Multiple Choice:

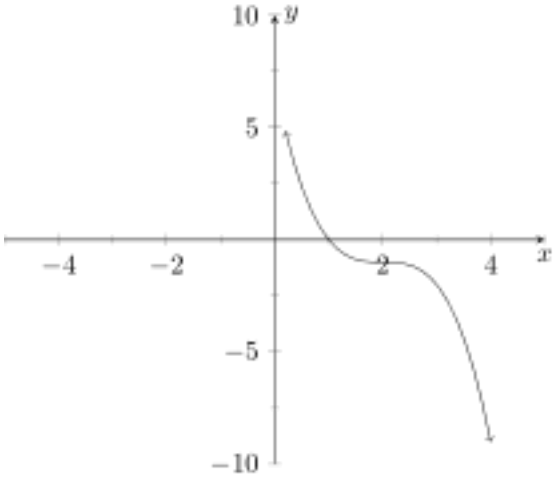
(a)



(b)

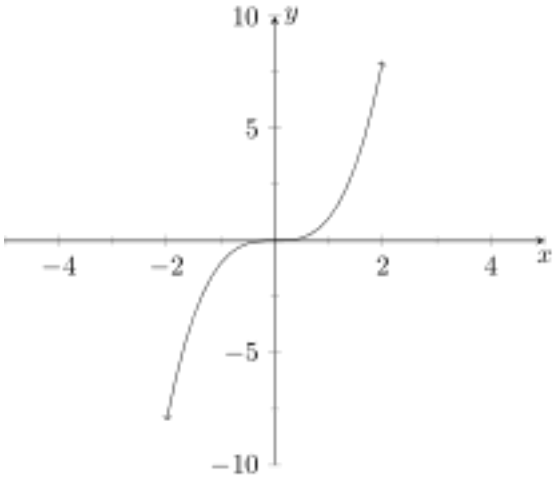


(c)

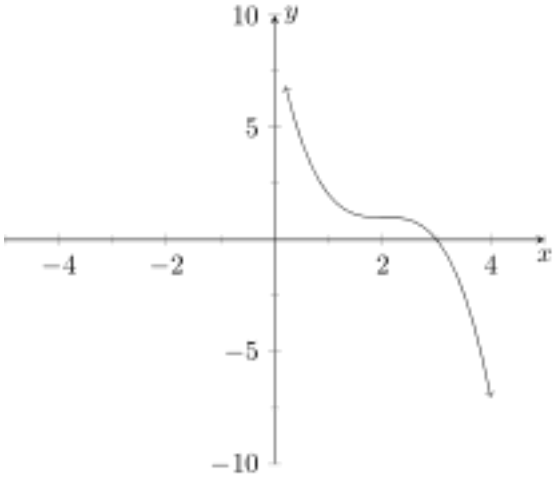


✓

(d)



(e)



Problem 23 *How many zeros (and what type) does the polynomial* $x^2 - 10\,x + 44$ *have?*

Multiple Choice:

(a) *It has no real zeros, but according to FTA is has 2 complex zeros.* ✓

(b) *According to FTA it has two real zeros and no complex zeros.*

(c) *According to FTA it has two real zeros and two complex zeros.*

(d) *Since it is degree two it has two zeros, one of which is complex, the other one is real.*

(e) *It has no real zeros, so it must have complex zeros; but we cannot determine how many.*

Problem 24 *Complete the square on the following quadratic form. (**Note:** You do not need to fully factor, just complete the square.)*

$$x^8 + 5\,x^4 - 7$$

Multiple Choice:

(a) $\left(x + \frac{5}{2}\right)^4 + \left(-\frac{53}{4}\right)$

(b) $\left(x^4 + \frac{5}{2}\right)^4 + \left(-\frac{3}{4}\right)$

(c) $\left(x^4 + \frac{5}{2}\right)^2 + \left(-\frac{19}{2}\right)$

(d) $\left(x^4 + \frac{5}{2}\right)^2 + \left(-\frac{53}{4}\right)$ ✓

(e) $\left(x + \frac{5}{2}\right)^2 + \left(-\frac{53}{4}\right)$

Problem 25 *Which of the following is a proper factorization of the polynomial $p(x) = (x-5)^2$ (using real coefficients):*

Multiple Choice:

(a) *This is not factorable with real coefficients.*

(b) $(x+5)(x-5)$

(c) $(x+5)(x+5)$

(d) $(x-5)(x-5)$ ✓

(e) $(x-5)(x+5)$

Problem 26 *Which of the following is not a special form for factoring polynomials with real coefficients?*

Multiple Choice:

(a) *These are all special forms.*

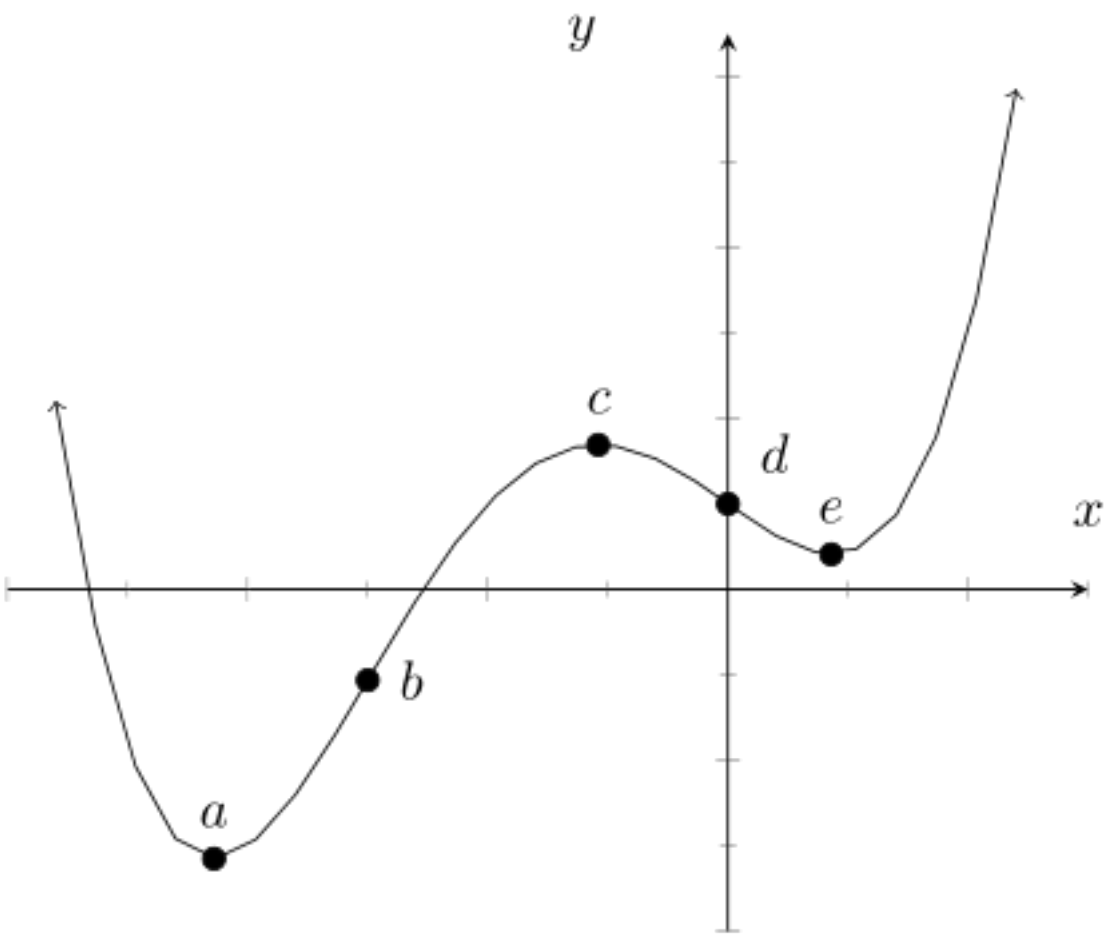
(b) *Difference of Squares*

(c) *Sum of Cubes*

(d) *Sum of Squares* ✓

(e) *Quadratic Form*

Problem 27 *Consider the following graph:*



Within which of the following segments is the function ***increasing*** *and concave* ***down****?*

Multiple Choice:

(a) *To the right of e*

(b) *Between c and d*

(c) *Between b and c* ✓

(d) *Between d and e*

(e) *Between a and b*

Problem 28 *Which of the following equations are polynomials?*

(a) $f(x) = x^2 + 1$

(b) $g(x) = \frac{1}{3}x^3 + 7$

(c) $h(x) = 7$

(d) $k(x) = x^3 + 3x^{\frac{1}{3}} + 1$

Multiple Choice:

(a) *All of them are Polynomials.*

(b) *I Only.*

(c) *IV Only.*

(d) *I, II, and III Only.* ✓

(e) *I and II Only.*

Problem 29 *What method is best for factoring out a complex-valued non-real zero of a polynomial?*

Multiple Choice:

(a) *Synthetic division, since a single zero means it's a linear factor.*

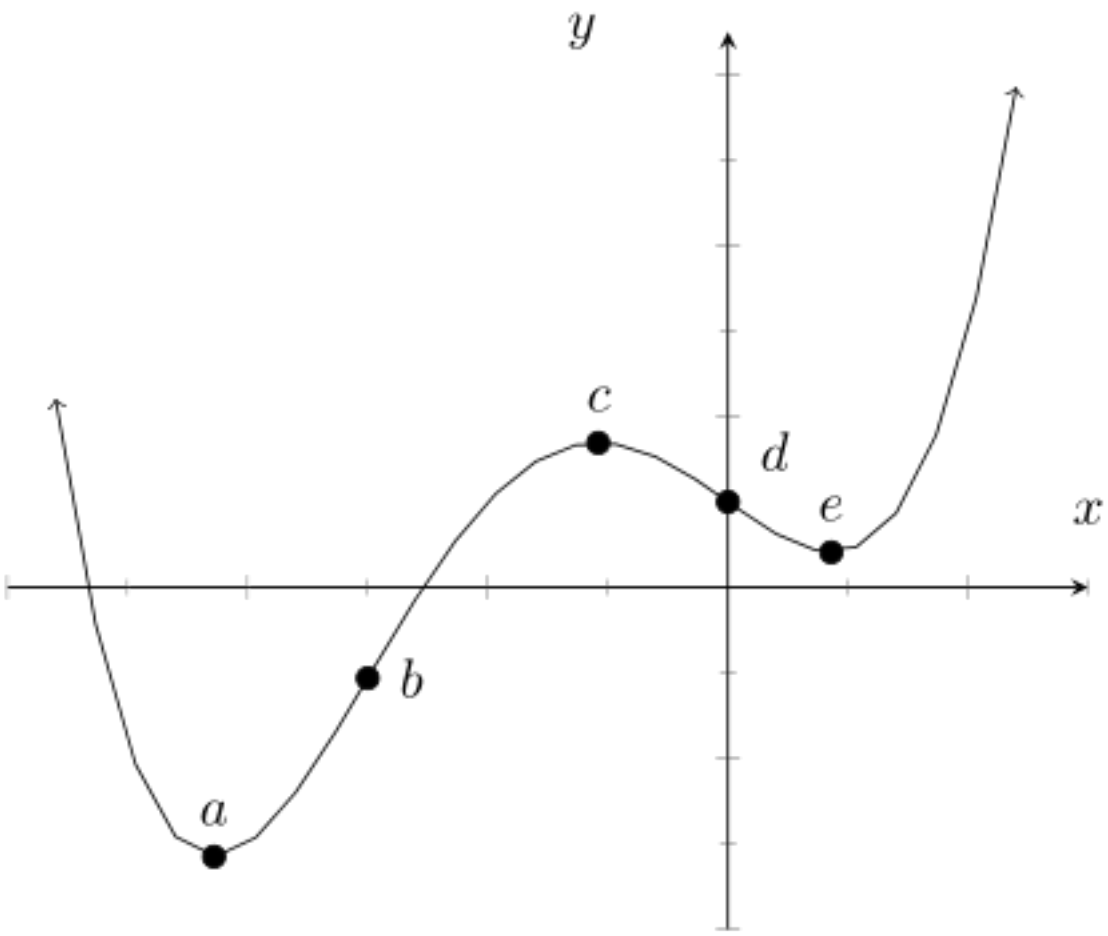
(b) *It could be any of our methods; which is best depends on the specific polynomial.*

(c) *Polynomial long division, using the conjugate of the provided zero.* ✓

(d) *Factor by Grouping, since we know the conjugate is also a zero.*

(e) *Quadratic Formula, since the provided zero is non-real.*

Problem 30 *Consider the following graph:*



Based on the number of extrema, what is the smallest degree possible for the leading term of f?

Multiple Choice:

(a) *4* ✓

(b) *5*

(c) *6*

(d) *3*

Problem 31 *Given a polynomial with leading term $-10\,x^8$ what can be said about the absolute extrema it has?*

Multiple Choice:

(a) *It has no absolute extrema.*

(b) *It must have an absolute maximum.*

(c) *It must have at least one absolute extrema; but we don't know if it is a max or min.*

(d) *There is not enough information to tell.*

(e) *It must have an absolute minimum.* ✓

Problem 32 *Which of the following is a proper factorization (using real coefficients) of the polynomial*

$$p(x) = 7\,x^2 - 15\,x - 18$$

Multiple Choice:

(a) *This is not factorable with real coefficients.*

(b) $(7\,x - 6)(x - 3)$

(c) $(7\,x + 6)(x - 3)$ ✓

(d) $(7\,x - 6)(x + 3)$

(e) $(7\,x + 6)(x + 3)$

Problem 33 *Consider the polynomial $p(x) = 96\,x^4 - 216\,x^3 + 72\,x^2 + 204\,x - 180$. What is the sum of the zeros of $p(x)$? Hint: $x - i\sqrt{\dfrac{10}{3}} + 1$ is a factor of $p(x)$.*

Multiple Choice:

(a) $-\dfrac{9}{4}$

(b) $-\dfrac{7}{4}$

(c) $i\sqrt{\dfrac{1}{2}}+\dfrac{5}{4}$

(d) $\dfrac{9}{4}$ ✓

(e) $\dfrac{1}{4}$

Problem 34 *Which of the following is a proper factorization of the polynomial* $p(x)=x^4-16$ *(using real coefficients):*

Multiple Choice:

(a) $\left(x^2+4\right)(x+2)(x-2)$ ✓

(b) *This is not factorable with real coefficients.*

(c) $\left(x^2+4\right)(x+2)^2$

(d) $\left(x^2+4\right)\left(x^2-4\right)(x-2)$

(e) $\left(x^2+4\right)\left(x^2-4\right)$

Problem 35 *Consider the polynomial:* $p(x)=(-13\,x^3)+(-24\,x^6)+(30\,x^7)+(3\,x)+(15\,x^8)$. *If we know one of the roots is a non-real complex number, what is the best we can say about the number of non-real roots that* $p(x)$ *has?*

Multiple Choice:

(a) *Nothing; there is not enough information.*

(b) $p(x)$ *has at most* 1 *non-real roots.*

(c) $p(x)$ *has at least* 2 *non-real roots.* ✓

(d) $p(x)$ *has at most* 2 *non-real roots.*

(e) $p(x)$ *has at least* 1 *non-real roots.*

Problem 36 *What degree factor can be used as a divisor with polynomial long division?*

Multiple Choice:

(a) *Any degree polynomial can be used with long division.* ✓

(b) *Only degree 1 polynomials with leading coefficient of 1 can be used.*

(c) *Only degree 1 or 2 polynomials can be used.*

(d) *Only linear polynomials (degree 1) can be used.*

(e) *Any degree can be used, but it must have leading coefficient of 1.*

Problem 37 *Consider the polynomial $p(x) = x^2 + 5\,x + C$. What would the value of C need to be in order for $p(x)$ to be a perfect square? (Hint: Try to complete the square and see what number you must add and subtract)*

Multiple Choice:

(a) $\frac{25}{4}$ ✓

(b) 5

(c) 25

(d) $\frac{5}{2}$

(e) *There is not enough information.*

Problem 38 *Simplify the following expression fully:*

$$\frac{-8i+1}{(4i+6)(5i-8)}$$

Multiple Choice:

(a) $-\frac{1}{89} + \left(-\frac{21}{178}\right) \cdot i$

(b) $\frac{21}{178} + \left(-\frac{1}{89}\right) \cdot i$

(c) $\frac{271}{2314} + \left(-\frac{21}{1157}\right) \cdot i$

(d) $-\frac{1}{89} + \left(\frac{21}{178}\right) \cdot i$ ✓

(e) $-\frac{21}{1157} + \left(\frac{271}{2314}\right) \cdot i$

Problem 39 *The AC method can be used on...*

Multiple Choice:

(a) *any polynomial that can be appropriately grouped for factoring.*

(b) *any polynomial with exactly three terms.*

(c) *any polynomial with any number of terms.*

(d) *any polynomial with three or fewer terms.*

(e) *any quadratic form* ✓

Problem 40 *When using polynomial long division, if the remainder is zero, what does this mean?*

Multiple Choice:

(a) *The divisor is not a factor of the polynomial.*

(b) *The divisor is a factor of the polynomial.* ✓

(c) *That the long division worked.*

(d) *The polynomial is irreducible.*

(e) *There is not enough information.*

Problem 41 *When factoring by grouping, you need to ensure that...*

Multiple Choice:

(a) *The original polynomial is at least degree 3.*

(b) *The leading coefficient is one.*

(c) *There are exactly 4 terms in the original polynomial.*

(d) *Each grouping has a linear polynomial remainder after factoring out the GCD.*

(e) *Each group has the same remainder after factoring out the GCD* ✓

Problem 42 *Which of the following is a proper full factorization of the polynomial* $p(x) = x^3 - 10\,x^2 - 4\,x + 40$ *(using real coefficients):*

Multiple Choice:

(a) $(x - 10)(x - 2)(x + 2)$ ✓

(b) *This is not factorable with real coefficients.*

(c) $(x + 10)(x^2 - 4)$

(d) $(x - 10)(x^2 - 4)$

(e) $(x - 10)(x^2 + 4)$

Problem 43 *Can you use Synthetic Division to divide the polynomial* $p(x) = -11\,x^{10} + 14\,x^8 - 2\,x^6 + 8\,x^5 + 10\,x^3 + 10\,x^2$ *by* $d(x) = x - 4$*?*

Multiple Choice:

(a) *No because* $x-4$ *is not the correct form; but it could be manipulated into the correct form.*

(b) *No because* $x-4$ *is the correct degree but not the right form, nor could it be manipulated to be so.*

(c) *Yes because* $x - 4$ *is the correct degree and is in the correct form.*

(d) *Yes because* $x - 4$ *is the correct degree and is in the correct form.* ✓

(e) *No because* $x - 4$ *is not the correct degree.*

Problem 44 *Consider the polynomial:* $p(x) = (-13\,x^3)+(-24\,x^6)+(30\,x^7)+(3\,x)+(15\,x^8)$. *If we know one of the roots is a non-real complex number, what is the best we can say about the number of real roots that* $p(x)$ *has?*

Multiple Choice:

(a) $p(x)$ *has at most* 8 *real roots.*

(b) $p(x)$ *has at least* 7 *real roots.*

(c) *Nothing; there is not enough information.*

(d) $p(x)$ *has at most* 6 *real roots.* ✓

(e) $p(x)$ *has at most* 7 *real roots.*

Problem 45 *Consider the polynomial* $p(x) = x^2 - 2\,x - 8$. *What is the sum of the zeros of* $p(x)$ ***after is has been shifted to the right*** *by* 4*?*

Multiple Choice:

(a) *The answer cannot be determined.*

(b) -10

(c) 10 ✓

(d) -6

(e) 6

Problem 46 *If you have tried every number listed by rational root theorem and found no roots (and made no mistakes), what does that tell you about the polynomial?*

Multiple Choice:

(a) *Nothing; there is not enough information.*

(b) *The polynomial may be factorable, but it will have irrational zeros.* ✓

(c) *The polynomial will not be factorable using real numbers.*

(d) *All the zeros of the polynomial are complex-valued.*

(e) *The polynomial may be factorable and it may have rational zeros.*

Problem 47 *Consider the polynomial* $p(x) = -36\,x^4 - 162\,x^3 - 282\,x^2 - 282\,x + 234$. *What is the sum of the zeros of* $p(x)$*? Hint:* $i\sqrt{\dfrac{10}{3}} - 1$ *is a zero of* $p(x)$.

Multiple Choice:

(a) $-\dfrac{1}{2}$

(b) $-\dfrac{5}{2}$

(c) $-\dfrac{9}{2}$ ✓

(d) $i\sqrt{\dfrac{10}{3}} - \dfrac{7}{2}$

(e) $\dfrac{9}{2}$

Problem 48 *Which of the following is a proper factorization (using real coefficients) of the polynomial*

$$p(x) = 15\,x^2 - 2\,x - 8$$

Multiple Choice:

(a) $(-5\,x - 3)(-3\,x - 2)$

(b) $(-5\,x + 4)(-3\,x - 2)$ ✓

(c) *This is not factorable with real coefficients.*

(d) $(-5\,x - 3)(x - 4)$

(e) $(-5\,x + 4)(x - 4)$

Problem 49 *Consider the polynomial* $p(x) = -32\,x^3 + 16\,x^2 + 128\,x + 80$. *How many zeros does this polynomial have counting multiplicity?*

Multiple Choice:

(a) 4

(b) 1

(c) 2

(d) 3 ✓

(e) 5

Problem 50 *What is the minimal degree polynomial one could use the rational root theorem on?*

Multiple Choice:

(a) 3

(b) 2

(c) *There is no minimum.*

(d) 1 ✓

(e) 0

Problem 51 *Given a polynomial with leading term* $-5\,x^6$ *what can be said about the number of absolute and relative extrema it has?*

Multiple Choice:

(a) *It has 1 absolute extrema and an odd number of relative extrema.* ✓

(b) *It has 1 absolute extrema and an even number of relative extrema.*

(c) *It has no absolute extrema and an odd number of relative extrema.*

(d) *It has no absolute extrema and an even number of relative extrema.*

(e) *It has 1 absolute extrema, but there is not enough information for relative extrema.*

Problem 52 *Given a polynomial with leading term $-5\,x^5$ what can be said about the number of absolute and relative extrema it has?*

Multiple Choice:

(a) *It has no absolute extrema and an odd number of relative extrema.*

(b) *It has 1 absolute extrema and an even (possibly 0) number of relative extrema.*

(c) *It has no absolute extrema, but there is not enough information for relative extrema.*

(d) *It has no absolute extrema and an even (possibly 0) number of relative extrema.* ✓

(e) *It has 1 absolute extrema and an odd number of relative extrema.*

Problem 53 *Which of the following is a factor of the polynomial $p(x) = 60\,x^4 - 53\,x^3 - 230\,x^2 + 9\,x + 126$?*

Multiple Choice:

(a) $x + 6$

(b) $x - 5$

(c) $x - 1$

(d) $x - \frac{7}{3}$ ✓

(e) $x - 3$

Problem 54 *Which of the following is a factor of the polynomial $p(x) = x^4 + 7\,x^3 - 34\,x^2 - 28\,x + 120$?*

Multiple Choice:

(a) $x - 6$

(b) $x + 1$

(c) $x + 2$ ✓

(d) $x + 8$

(e) $x + 3$

Problem 55 *Which of the following is a proper factorization of the polynomial $p(x) = (x + 6)(x + 5)$ (using real coefficients):*

Multiple Choice:

(a) *This is not factorable with real coefficients.*

(b) $(x + 5)(x + 6)$ ✓

(c) $(x - 5)(x + 6)$

(d) $(x - 5)(x - 6)$

(e) $(x + 5)(x - 6)$

Problem 56 *Consider the polynomial $p(x) = 33\,x^3 - 11\,x^2 - 19\,x + 35$. According to the rational root test, which of the following is **NOT** a possible zero of $p(x)$?*

Multiple Choice:

(a) $x = \dfrac{5}{11}$

(b) $x = \dfrac{5}{3}$

(c) $x = \dfrac{3}{7}$ ✓

(d) $x = \dfrac{7}{11}$

(e) $x = \dfrac{7}{3}$

Problem 57 *Which of the following is a zero of the polynomial $p(x) = x^4 + 8\,x^3 - 63\,x^2 - 470\,x - 400$?*

Multiple Choice:

(a) -1 ✓

(b) 5

(c) -14

(d) -3

(e) -8

Problem 58 *Given a polynomial of degree 9 what can be said about the absolute extrema it has?*

Multiple Choice:

(a) *It must have an absolute minimum.*

(b) *It must have at least one absolute extrema; but we don't know if it is a max or min.*

(c) *There is not enough information to tell.*

(d) *It has no absolute extrema.* ✓

(e) *It must have an absolute maximum.*

Problem 59 *Simplify the following expression fully:*

$$\frac{3i+7}{(7i+6)\overline{(4i-10)}}$$

Multiple Choice:

(a) $-\frac{13}{170}+\left(\frac{1}{170}\right)\cdot i$ ✓

(b) $-\frac{293}{4930}+\left(-\frac{239}{4930}\right)\cdot i$

(c) $\frac{1}{170}+\left(-\frac{13}{170}\right)\cdot i$

(d) $-\dfrac{13}{170}+\left(-\dfrac{1}{170}\right)\cdot i$

(e) $-\dfrac{239}{4930}+\left(-\dfrac{293}{4930}\right)\cdot i$

Problem 60 *Factor the polynomial* $p(x)=x^6-9\,x^3+8$ *using real coefficients.*

Multiple Choice:

(a) $(x^3-1)(x^3-8)$

(b) $((x+2)(x-1))(x^2+x+1)(x^2-2\,x+4)$ ✓

(c) $((x+2)(x-1))(x^2+x+1)((x-1)^2)((x-4)^2)$

(d) $((x-1)^2)((x-4)^2)(x^2-1)$

(e) $p(x)$ *cannot be factored further.*

Problem 61 *Which of the following is a proper factorization of the polynomial* $p(x)=x^3+4\,x^2+2\,x+8$ *(using real coefficients):*

Multiple Choice:

(a) $(x-4)(x-2)(x+2)$

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

(c) $(x+4)(x^2+2)$ ✓

(d) *This is not factorable with real coefficients.*

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

Problem 62 *Given a polynomial of degree* 8 *what can be said about the absolute extrema it has?*

Multiple Choice:

(a) *There is not enough information to tell.*

(b) *It must have at least one absolute extrema; but we don't know if it is a max or min.* ✓

(c) *It must have an absolute minimum.*

(d) *It has no absolute extrema.*

(e) *It must have an absolute maximum.*

Problem 63 *Consider the monomial* $p(x) = -3\,x^8$. *Is* $p(x)$ *increasing, or decreasing to the right of the origin?*

Multiple Choice:

(a) $p(x)$ *is increasing over some of the interval and decreasing over other parts.*

(b) $p(x)$ *is is decreasing* ✓

(c) $p(x)$ *is is increasing*

(d) *There is not enough information to tell.*

(e) $p(x)$ *is neither increasing nor decreasing over that interval.*

Problem 64 *When using the technique of Completing the Square, you will end up with...*

Multiple Choice:

(a) *a binomial to a power with (possibly many more) terms added or subtracted.*

(b) *a perfect square, but you may have to add or subtract a constant to it.* ✓

(c) *None of these options are correct.*

(d) *some perfect power (not necessarily square) plus or minus a constant.*

(e) *a perfect square, always.*

Problem 65 *Which of the following is a proper factorization of the polynomial* $p(x) = (x + 8)(x + 5)$ *(using real coefficients):*

Multiple Choice:

(a) $(x - 8)(x + 5)$

(b) $(x + 8)(x + 5)$ ✓

(c) $(x - 8)(x - 5)$

(d) *This is not factorable with real coefficients.*

(e) $(x + 8)(x - 5)$

Problem 66 *Consider the polynomial* $f(x) = x^2 - 12\,x + 36$. *Which of the following statements are true?*

I: $f(x)$ *has 2 roots but no real zeros.*

II: $f(x)$ *has 2 roots and 2 real zeros.*

III: $f(x)$ *is degree 2 which is why it must have 2 real zeros.*

IV: $f(x)$ *is degree 2 but has no real zeros.*

Multiple Choice:

(a) *None of these are correct.*

(b) *Only II is correct.* ✓

(c) *Only I is correct*

(d) *Only II and III are correct*

(e) *Only I and IV are correct*

Problem 67 *Which of the following is a proper full factorization (using real coefficients) of the polynomial:*

$$p(x) = x^5 - 14\,x^4 + 49\,x^3 - 125\,x^2 + 1750\,x - 6125$$

Hint: *Use factor by grouping.*

Multiple Choice:

(a) $(x^2 - 14\,x + 49)(x^3 - 125)$

(b) *This is not factorable with real coefficients.*

(c) $(x - 7)^2(x^3 - 125)$

(d) $(x - 7)^2(x - 5)(x^2 + 5\,x + 25)$ ✓

(e) $(x - 7F)(x - 5)(x^2 + 5\,x + 25)$